

Katja Pynnönen

Social Engagement, Mood, and Mortality in Old Age



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and Mortality in Old Age

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Social Engagement, Mood, and Mortality in Old Age

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Katja Pynnönen

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and Mortality in Old Age



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ABSTRACT

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Social relationships, social activity, and experiencing fulfilment of interpersonal needs are essential aspects of well-being in older people. The purpose of this research was twofold: first, to investigate the associations of various dimensions of social activity and perceived togetherness with indicators of health decline; and second, to identify potential mediators in these associations.

This dissertation is based on data from two research projects. The first, the Evergreen project, is a multidisciplinary, longitudinal follow-up study on the health and functional capacity of people aged 65–84 in 1988 (n=1 181) resident in Jyväskylä, Finland. Data on institutionalization and mortality were obtained from local and nationwide registers. The second, Promotion of mental well-being in older people (GoodMood), was a randomized controlled trial lasting for 1.5 years targeting persons aged 75–79 years (n=222–223) who reported symptoms of loneliness or melancholy at study entry. In both studies, data on social factors and health were gathered in face-to-face interviews.

The results showed that those who were more active in collective social activity had reduced risk for mortality and institutionalization over the 17-year follow-up. Better mobility partially explained the association between collective and productive social activities and mortality risk. Better cognitive functioning and fewer depressive symptoms were prerequisites for participating in social activities. Of the dimensions of perceived togetherness, higher sense of attachment and opportunity for giving nurturance at baseline predicted a lower number of depressive symptoms at follow-up. In addition, the presence of depressive symptoms and loneliness at baseline predicted lower scores in the dimensions of perceived togetherness at follow-up. A social intervention of choice increased experiences of social integration, but did not affect depressive symptoms. Loneliness and melancholy were attenuated over time, also equally among controls, suggesting no additional benefit from the social intervention.

Collective and productive social activity may contribute to preventing health decline in older people. A higher level of social activities and contentment in perceived togetherness, less frequent feelings of loneliness and fewer depressive symptoms often co-exist, but increased social activity may not lead to improvements in these variables.

Keywords: Social activity, loneliness, perceived togetherness, mortality, depressive symptoms, old age

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LIST OF ORIGINAL PUBLICATIONS

This dissertation is based on the following papers which will be referred to by their Roman numbers. The dissertation also includes unpublished data.

- I Pynnönen K, Törmäkangas T, Heikkinen R-L, Rantanen T, Lyyra T-M. 2012. Does social activity decrease risk for institutionalization and mortality in older people? *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* 67 (6): 765-774, doi: 10.1093/geronb/gbs076.
- II Pynnönen K, Törmäkangas T, Rantanen T, Lyyra T-M. 2014. Do mobility, cognitive functioning, and depressive symptoms mediate the association between social activity and mortality risk among older men and women? *European Journal of Ageing* 11: 121-130, doi: 10.1007/s10433-013-0295-3.
- III Pynnönen K, Rantanen T, Tiikkainen P, Kokko K, Kallinen M, Törmäkangas T. Associations between the dimensions of perceived togetherness, loneliness, and depressive symptoms among older Finnish people. Accepted to *Aging & Mental Health*.
- IV Pynnönen K, Törmäkangas T, Rantanen T, Tiikkainen P, Kallinen M. 2016. Effect of a social intervention of choice vs. control on depressive symptoms, melancholy, feeling of loneliness, and perceived togetherness in older Finnish people: A randomized controlled trial. *Aging & Mental Health*, doi: 10.1080/13607863.2016.1232367.

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1 INTRODUCTION

People are fundamentally social and live all their lives amidst social networks, language, habits, norms, societal structures, and their own historical era. Ideally, people have family members, relatives, and friends with whom to live their everyday lives or share leisure activities and experiences. Conceptually, a social network can be defined as a social structure made up of a set of social actors, sets of dyadic ties, and other social interactions between actors (see O'Reilly 1988; Due et al. 1999). Close members of a person's social network are often givers and receivers of social support, which can be defined as the social resources provided by other persons (Due et al. 1999). Social support may involve providing help with practical matters, giving advice, or emotional support (Santini et al. 2016). Workmates and other participants in leisure activities and hobbies of the person's network form a somewhat wider circle which among other things enables acting together, obtaining information, and experiencing feelings of belonging to a group.

As people age, many of them encounter major changes in their social network. With retirement, workmates are no longer met regularly. With widowhood, many continue living their lives alone. For older people who have experienced losses in their social network, children may offer social support but typically they are not able to compensate for the loss of everyday companionship. Many people living a long life report that friends of their own age have fallen severely ill or died. In old age, in addition to changes in their social networks, people may abandon their valued activities and hobbies due to declining functional abilities, which may further reduce their social contacts (Carstensen 1992; Van Tilburg 1998).

This research focused on social participation, especially collective and productive social activity, and its association with indicators of health decline, such as risk for mortality and institutionalization. Also in focus was the qualitative aspects of social relationships, conceptualized here as perceived togetherness, and its associations with depressive mood and loneliness. The concept "social engagement" refers both to being socially active and meeting other people, and to how a person experiences interaction with other people.

Collective social activity is defined as spending time and doing things together with other people such as visiting cultural events, travelling, exercising in a group, dancing, or participating in organizational or congregational activities. *Productive social activity* means that a person is using his or her knowledge and capabilities in helping other people or generating common well-being. Doing volunteer work or giving informal help in various activities are examples of productive social activity. The resources people provide and the needs met by participating in collective and productive social activities differ. Thus, collective and productive social activities represent different dimensions of social activity.

Another important aspect, alongside the structure of the social network and frequency of contacts with the members of one's network, is how a person's expectations of his or her relationships are fulfilled. From the point of view of *loneliness*, fulfilment of one's expectations of one's social relationships is more important than the structural features of the social network (Weiss 1973, 17; Routasalo et al. 2006). According to Weiss (1973), different types of relationships meet different interpersonal needs or offer different social provisions. Weiss (1974) identified six social provisions: attachment, social integration, reliable alliance, guidance, opportunity for nurturance, and reassurance of worth, which form the dimensions of *perceived togetherness* (Tiikkainen, Heikkinen & Leskinen 2004).

The importance of the different dimensions of perceived togetherness may vary from person to person depending among other things on age and life situation (Weiss 1974). Thus, there is a need to investigate the associations between the dimensions of perceived togetherness, feelings of loneliness, and depressive symptoms among older people. Such knowledge helps lay the foundation for planning interventions to alleviate loneliness and increase mental well-being among older people.

Research on the association between social relationships and health decline began several decades ago. Studies conducted around the 1980s focused on the associations of social ties and lack of social support with mortality risk (Berkman 1986). In this dissertation, to capture the factors and pathways leading to declining health, I investigated mortality as an outcome in predictive models. It is worth noting that a distinction is made between early predictors of mortality and immediate contributing causes of death. Predictors of mortality refer to factors observed in earlier life which increase susceptibility to health decline and mortality. Immediate causes of death, in turn, refer to diseases, injuries, or events that precipitate death.

Risk for institutionalization describes one outcome of a decline in health and functioning, but it also is related to the level of availability of long-term care in the social and health care system. As a study outcome, it is more ambiguous than mortality, as the criteria for institutionalization change over time, along with models of financing and organising social and health care differ between countries, while the need for institutionalization may also depend on the ability of the person's social network to provide support and care. All these factors underlie the risk for institutionalization in old age.

Health is a broad concept. According to the World Health Organization, health is “a state of complete physical, mental, and social well-being and not merely the absence of disease or injury” (WHO 1946). Depressive symptoms and feelings of melancholy, other outcomes investigated in this dissertation research, can be used to measure decline in a person’s mental well-being. Loneliness is a social phenomenon but also an inner personal experience. Thus, it may be used to measure decline in a person’s social as well as mental well-being.

Lisa Berkman and colleagues (2000) have constructed a conceptual model on how social networks impact health. Social networks are embedded in a larger cultural and social context that shapes the network structure and behaviour of people with each other and in society. According to the model, social networks enable or operate through social support, social influence, social engagement, person-to-person contacts, and access to resources and material goods. In turn, these mechanisms impact health via physiological and psychological pathways more proximate to the health outcomes. Social engagement is one potential psychosocial mechanism through which social networks may influence the health of people. With the concept of “social engagement”, I refer, first, to being socially active, meeting with other people, and doing things together, and second, to how a person experiences interaction in his or her social relationships.

Among the Finnish community-dwelling older population, approximately 5 % report feeling lonely often or almost always (Savikko et al. 2005; Tiikkainen & Heikkinen 2005) and 39 % suffer from loneliness at least occasionally (Routasalo et al. 2006). Over one-third of 75-year-old women and one-quarter of same age men were depressed, with the proportion of depressed persons increasing, particularly among women, from age 80 to 85 years (Heikkinen & Kauppinen 2004). Feeling lonely and depressed may be temporary adjustment reactions to declining health and changes in a person’s social network. However, when depressive symptoms and loneliness become prolonged, a person may need support to recover. Previous systematic reviews have concluded that interventions that were effective in decreasing loneliness among older people were typically conducted in a group setting, included some form of educational or training input and social activity, and involved active participation (Cattan et al. 2005; Dickens et al. 2011). However, the effectiveness of the interventions studied in alleviating loneliness and depressive symptoms in older people varied (Dickens et al. 2011).

We live in a society where the post-World War II Baby Boomer Generation (born 1945-1950) has mainly retired or is retiring. One in every five of Finnish people was aged 65 years or over at the end of 2016 (Official Statistics of Finland). The subsequent generations, as well, are large in Finland which means that proportion of people in so-called third age will be substantial. In the third age, people usually have more time and their health and functional capacity are good or moderate. On the other hand, proportion of those aged 80 years or over, when need for more help usually begins to increase, was 5.2 % at the end of 2016. From the perspective of health promotion, it is important to take into ac-

count those ageing persons who are able to participate in various activities in their social network, hobbies, and a society level, as well as those who have more restricted possibilities to take part in those activities. Being socially active and having supportive, good social relationships may enhance health and well-being of older people. On the other hand, loneliness and depressive symptoms are signs of ill-being which should be acknowledged in order to promote well-being of these people. Furthermore, in the light of the ageing of societies, studies on predictors of early mortality, lowered wellbeing, and productive social participation are timely and relevant, both for policy makers and stakeholders who are confronted with increasing costs for public health and sustainability of welfare states, and academics evaluating the beneficial effects of social engagement on different health outcomes.

The research reported in this dissertation focuses on 1) the associations between social activity, especially collective and productive social activity, and risk for mortality and institutionalization among older people; 2) mobility, depressive symptoms, and cognitive functioning as potential mediators in the associations between social activity and mortality risk; 3) the dimensions of perceived togetherness as factors potentially explaining loneliness and depressive symptoms in older people; and 4) the effects of social intervention on feelings of loneliness, melancholy, and depressive symptoms among older people who reported loneliness or depressed mood at the study entry. In all, gaining more knowledge on the association between social activity and the afore-mentioned outcomes may help to understand and promote well-being in older people.

2 REVIEW OF THE LITERATURE

2.1 Social engagement of older people

2.1.1 The macro, mezzo, and micro structures of social life

There is a lack of consistency in the use and precise meaning of the concepts applied in describing the social dimension of human life. Some of the most commonly used terms are social network, social relations, social support, social activity or participation, social engagement, and social integration (Mendes de Leon 2005). These concepts have their own definitions but they have also been used in overlapping ways in different studies. Several aspects of social life are identified in the conceptual model constructed by Berkman and her colleagues (2000) in a way that I considered useful for my research.

In Berkman's model, the largest social structure is the "macro" level that affects the social network structure and people's social behaviour (Berkman et al. 2000). For example, norms, values, ageism, sexism, social cohesion shape the structure of social networks and people's behaviour in social life. Socioeconomic factors such as inequality, conflict, the labour market, and economic recession, and political factors such as the political culture, laws, and public policy may partly regulate how people manage in their everyday life. In addition, social change, such as increasing urbanization and individualization, has an influence on people's lives. Various social-structural conditions may also affect people's lives in different ways or to a different extent, depending on age. In addition, taking both the historical era a society is in and the historical background of a person into account may be important in understanding the effect of the "macro" level on the habits, behaviours, experiences, and health conditions of people.

The social network forms the "mezzo" level and includes the individuals with whom one has an interpersonal relationship and the linkages between those individuals (see O'Reilly 1988; Due et al. 1999). A social network may be described by a) its size, the number of people belonging to the network, b) its density, the extent to which the members are connected to each other, c) its

boundedness, i.e., the degree to which they are defined on the basis of e.g. kin, work, neighbourhood, and d) its homogeneity, i.e., the extent to which the individuals in the network are similar to each other (Berkman et al. 2000). Frequency of face-to-face and nonvisual contacts, frequency of organizational participation, reciprocity, duration, and intimacy of ties are examples of characteristics of network ties (Berkman et al. 2000).

The provision of social support, social influence, social engagement and attachment, person-to-person contacts, and access to resources and material goods are aspects of the “micro” or psychosocial behavioural level (Berkman et al. 2000). *Social support* can be defined as the resources provided by other persons (Due et al. 1999). Social support includes instrumental, informational, appraisal, and emotional support. Instrumental support refers to help and assistance with tangible needs such as shopping, cleaning, preparing meals, and self-care tasks. Informational support refers to advice and information on services giving assistance with specific needs, and appraisal support to help in decision making, giving appropriate feedback, or help in deciding which course of action to take. Emotional support refers to the availability of love and caring, sympathy and understanding, and esteem or value from others (Thoits 1995). Some social ties provide several types of social support, while others are specialized, and provide only one type of social support (Berkman et al. 2000). It is also important to notice that social relationships are not always positive. At times, people may experience negative interaction with their social network members. Relational strain, a negative dimension of social relationships, is distinct from lack of social support (Due et al. 1999). Examples of relational strain include e.g. acting as a caregiver, negative interaction with family members, and abuse and violence.

Social networks affect health through *social influence*. The norms and values of the social network and peer pressure may affect individuals’ health behaviours, such as alcohol consumption, eating habits, or health care utilization (Berkman et al. 2000). Social influence also involves comparing other people’s social behaviour, attitudes, and reactions to one’s own to reduce uncertainty, ambiguity, and confusion, and provide guidance on how one should respond in a given situation (Hill 1987; Hill 2009). In addition, social networks may facilitate *access to resources and material goods* through diffusion of influence and information (Berkman et al. 2000; see also Granovetter 1983).

In this research, the focus was in *social engagement*, which is one potential psychosocial mechanism through which social networks can influence the health of people. Social engagement refers, for instance, to getting together with friends, attending social functions, participation in occupational or social roles, group recreation, or church attendance (Berkman et al. 2000). Through opportunities they provide for engagement, social networks define and reinforce meaningful social roles, which in turn, provide a sense of attachment, belonging, and value. Network participation also provides opportunities for companionship and sociability. According to Hill (1987; 2009), people may affiliate with other people because contact and interaction with others are commonly enjoya-

ble and they can attract attention from other people. In addition, social engagement may give meaning to an individual's life by enabling him or her to more fully participate in society, to be obligated through providing support to other people, and to feel attached to his or her community (Berkman et al. 2000; see also Keyes 1998).

2.1.2 Social relationships in old age

With ageing, the composition of the social network often changes. Among older people, the proportion of those widowed increases with age, especially in women. For example, in the Finnish Evergreen study, 10 % of the men in the age group 65–74 and 19 % in the age group 75–84 were widowed. Among women, the corresponding proportions were 41 and 63 %. In addition, 7 % of participants were divorced. One's partner is an important person with whom to share everyday tasks and everyday life. Men have been found to be more satisfied with their marriage than women (Santini et al. 2016). Overall, men and women seem to have different expectations, criteria, experiences, and ways of evaluating their intimate supportive relationships (Antonucci & Akiyama 1987). Married men tend to rely on their spouses as confidants whereas older married women have larger social networks and receive support from multiple sources (Antonucci & Akiyama 1987). A slightly larger proportion of women received emotional support from their children compared to men. In the Evergreen study, 74 % of the participants who had children had children living in the same city. Two-thirds met their children at least weekly, and almost half reported a child as the closest person to him or her. For widowers in the Evergreen data, three out of four mentioned a child as the person closest to them.

Siblings are important persons in the social network of older people as these relationships are usually life-long, and siblings have a shared history with their parents and each other during their childhood. In the Evergreen data, the proportion of the respondents who never married was 3 % among men and 14 % among women. Half of them reported a sibling and every fifth another relative as the person closest to them.

Friends provide a very different form of relationship in the sense that friendships are voluntary in nature. Networks of friends may provide companionship, social support, and intimacy (Hartup & Stevens 1997). Friendships may also promote the well-being of older adults into old age through socialization and helping them maintain their identity during major changes in life such as widowhood. Close friends are often identified by older person as old friends who share memories of the past (Johnson & Troll 1994). In the Evergreen study, 70 % of men and 80 % of women reported having at least one friend. Among those aged 85 and over, one-half had at least one close friend and three out of four were in weekly contact with those they identified as friends (Johnson & Troll 1994). Those "identified as friends" referred to casual and club friends. Casual friends are available because they live nearby or are fellow members of e.g. senior centers. Club friends are encountered in activities related to hobbies

but are not generally seen outside that specific context (Johnson & Troll 1994). To sum up, in addition to person-to person contacts or meeting friends in small groups, many leisure activities or hobbies provide opportunities to meet friends and acquaintances, as well as to form new social connections. Personality factors such as sociability facilitate a life-long pattern of socializing.

Greater age increases the number of family members and decreases the number of friends. In addition, a decrease in contact frequency with friends in old age has been observed (Van Tilburg 1998; Aartsen et al. 2004). As friends are often age peers, the increased age of friends increases the probability that they have died or become too incapacitated to maintain interaction. With increased disability and subsequent dependency, it becomes more difficult to sustain equity in the reciprocity expected of friendship. Problems in mobility hinder meeting friends, and hearing problems interfere with interaction (Johnson & Troll 1994).

2.1.3 Social activity among older people

Social activity refers to human interaction occurring in informal and formal contexts (Utz et al. 2002). Interaction in informal contexts includes, for example, contacts via phone, skype, letters, e-mail, or social media, and getting together with family members, relatives, friends, and neighbours. Interaction in formal contexts includes activities such as attending meetings of organizations or clubs, religious participation, and volunteer work. The kinds of social activities that have often been investigated include attending activities such as cultural and sporting events, religious services, and organizational events, going on trips, participation in social groups, visiting relatives and friends, doing voluntary work, and helping other people (e.g. Krueger et al. 2009). In some studies, leisure activity has included activities carried out in a social context but also activities usually conducted alone, such as reading books (Agahi, Ahacic & Parker 2006) or working in the garden and preparing meals (Glass et al. 2006).

Based on the content and context of the activity, the prerequisites for participation, and the consequences for society, social activity has been conceptually divided into collective, productive, and political social participation (Bukov, Maas & Lampert 2002). In this dissertation research, the focus was solely on the collective and productive aspects of the conceptual model. When participating in *collective social activity*, a person spends time and acts together with other people. This kind of activity can also be viewed as personal involvement in the community, where the individual is more concerned with his or her own development and well-being (Broese van Groenou & Deeg 2010). Collective social activity includes leisure activities which offer opportunities for socializing, interaction, and sharing experiences (Mannell & Kleiber 1997), and function as a source of emotional support (Hill 1987; Hill 2009). For instance, visiting cultural events, travelling, exercising in a group, dancing, or participating in organizational or congregational activities can be categorized as collective social activities. *Productive social activity* occurs when a person is doing something for the well-being of another person or for common good. Doing volunteer work and

helping others are examples of productive social activity (Bukov, Maas & Lampert 2002).

The reason for dividing social activity into the dimensions of collective and productive activity is that the consequences of an activity for the person doing the activity may vary depending on its type. Collective social activity provides a feeling of being liked, trusted, accepted, and understood, and thus satisfies the need of affection (Steverink & Lindenberg 2006) and mattering to others (Taylor & Turner 2001). Collective social activities may enhance the sense of belonging to a group with whom one shares common interests and social activities (Weiss 1973, 145, 150; Mancini & Blieszner 1992).

Productive social activity may bring feelings of doing good things, doing things well, being a good person, being useful, contributing to a common goal, and being part of a functional group, and thus satisfy the need of behavioural confirmation (Steverink & Lindenberg 2006). Thus, productive activity may generate experiences of reassurance of worth, i.e. a sense of competence and esteem (Krause & Shaw 2000), and give an opportunity for nurturance, i.e. being responsible for the care of others (Weiss 1974), and feeling needed (Boman et al. 2015).

Over the life-course, social activities show considerable stability. Agahi and colleagues (2006) found that those who were active participants in leisure activities when they were aged 43–65 were active participants in the same leisure activities when aged 77–99. However, a decline in the rate of participation was the most common pattern over time seen in their study. The continuity theory of aging suggests that people tend to maintain their existing patterns of thoughts, activities, and habits with ageing (Atchley 1989). Older people may maintain continuity and habits by selecting the activities they prioritize the most, by engaging in activities that stimulate the body and mind in order to increase the reserve capacity needed to continue participation, and by finding compensatory strategies in order to continue engaging in their chosen activities despite reductions or losses in capacity (Baltes & Baltes 1990). Variables related to changes in activities have been found to be age, gender, education, self-rated health, marital status, and functional ability (Strain et al. 2002). Some studies suggest that health problems may be a major reason for a reduction in social participation in old age (Bukov, Maas & Lampert 2002; Wilkie et al. 2016). However, the results of Agahi and colleagues (2006) also support the activity theory of aging (Lemon, Bengtson & Peterson 1972). Their sample included persons who, also in late life, started new activities, such as dining out, going dancing, or attending study circles.

2.1.4 Perceived togetherness, social well-being, and loneliness among older people

In addition to being socially active, another important aspect of social engagement is how a person experiences his or her social relationships. From the point of view of well-being, satisfaction with the social relationships a person has is more central than the actual size and composition of their network

(Antonucci, Fuhrer & Dartigues, 1997; Fuller-Iglesias, 2015), although these two factors have been found to correlate, particularly among men (Pulkkinen, Lyyra & Kokko, 2011). Expectations and experiences can be explored from private or public life perspectives (see Keyes 1998). Private side of life concerns more the relationships between individuals, whereas public side of life concerns more the relationship between the individual and society.

People have a fundamental need and motivation to form frequent, affectively pleasing, and relatively enduring relationships with at least a few other people (Baumeister & Leary 1995). But why do people who have something common or who have shared experiences, often form friendships or other close social relationships? Why do people resist breaking social ties and lose attachments, although there may not be any material and practical reason to maintain the tie, and although maintaining it would be difficult? According to Weiss (1974), different types of relationships offer different social provisions which are important to the well-being of older people. In his social provisions theory, Weiss (1974) identified six dimensions that describe the interpersonal needs of people; these he termed social provisions (see also Russell et al. 1984). They were named: *attachment*, *social integration*, *guidance*, *sense of reliable alliance*, *opportunity for nurturance*, and *reassurance of worth*. *Attachment* stems from the feeling of safety and security, most often experienced in spousal relationships or relationships with close friends. *Social integration* refers to the sense that there are people around one who appreciate the same things or have the same concerns and to the sense of belonging to a group. *Reliable alliance* refers to relationships in which the person can count on assistance under any circumstances. *Guidance* is available in relationships with trustworthy and authoritative individuals who can provide advice and assistance. *Opportunity for nurturance* refers to feelings of being responsible for the well-being of another, typically most often present in spousal relationships and relationships with children, and *reassurance of worth* to the feeling that the person's skills and abilities are acknowledged. In this research, I have used the term *perceived togetherness* to refer to the six dimensions of perceived togetherness described above as it illustrates a positive angle on social relations better than the term social provisions (see Tiikkainen, Heikkinen & Leskinen 2004). In sum, perceived togetherness refers to the way people feel their existing social relations meet their needs and expectations.

Weiss (1974) focuses on the relationships between individuals, whereas Keyes (1998) describes social well-being from the point of view of the relationship between the individual and society. *Social well-being* describes an individual's appraisal of his or her circumstance and functioning in society. As a dimension of social well-being, *social integration* refers to the feeling of being part of society and that one has something common with others. *Social acceptance* manifests in experiences of having trust in others, of believing that others are capable of kindness, and of feeling comfortable with others. *Social contribution* refers to the belief that one is a vital member of society and has something of value to give to the world. In addition, the sense that society has potential for good which is being realized through its institutions and citizens, and the feeling that

one can understand what is happening around one are components of social well-being (Keyes 1998). Of the dimensions of social well-being described by Keyes (1998), social integration, social acceptance, and social contribution have more or less interfaces with the dimensions of perceived togetherness proposed by Weiss (1974).

In our society, ageing brings with it challenges for maintaining social well-being. Perhaps the most obvious or visible indicator of reduced social well-being among older people is loneliness (De Jong Gierveld & Van Tilburg 2006). Approximately 5 % of the Finnish older population reported feeling lonely often or almost always (Savikko et al. 2005; Tiikkainen & Heikkinen 2005) and 39 % reported suffering from loneliness at least occasionally (Routasalo et al. 2006).

Loneliness is an unpleasant subjective experience that occurs when a person's network of social relationships is significantly deficient in either quality or quantity (Peplau & Perlman 1982). Experience of loneliness has been found to range from feelings of isolation, sadness, loss, and lonesomeness to fear and boredom among older people (Smith 2012). From a deficit perspective, loneliness can be viewed as result of a lack of certain types of relationships within a person's social network (Dykstra & Fokkema 2007). Based on the assumption that different types of relationships serve different, more or less unique functions, Weiss (1973, 18-19) differentiated two forms of loneliness - emotional loneliness and social loneliness - which may co-exist or occur independently. Emotional loneliness arises in the absence of a close reliable emotional attachment figure, and social loneliness is related to a lack of social integration and embeddedness. Depression and vague unfocused dissatisfaction characterize both forms of loneliness. However, anxiety is more specific to emotional loneliness whereas boredom and feelings of exclusion are predominant in social loneliness. From a cognitive perspective, loneliness is primarily an outcome of a discrepancy between people's desires and reality, i.e., differences between an individual's preferred and actual social relationships, rather than merely of the absence of personal relationships (Dykstra & Fokkema 2007).

Feelings of being connected to significant others and embeddedness to the social network counteract loneliness (De Jong Gierveld & Van Tilburg 2006; Cacioppo et al. 2015). Empirical studies have shown that lack of attachment, social integration, and reliable alliance among community-dwelling 80-year-old persons (Tiikkainen & Heikkinen 2005), lower attachment among nursing home residents without cognitive impairment (Drageset, Espehaug & Kirkevold 2012), and lower attachment, social integration, and reassurance of worth in college students (Kraus et al. 1993) were related to the presence of loneliness. Both in older and younger people, missing the partner as an attachment person and missing the daily structuring element of a partner in the household was a risk factor for emotional loneliness. On the other hand, contact with children has been seen as a major pathway toward social integration of older adults into the broader community, thus preventing the risk of social isolation (De Jong Gierveld & Van Tilburg 2010).

Being alone is not necessarily being lonely. Although living alone has been found to be associated with loneliness among older people (e.g. Routasalo et al. 2006), another finding was that loneliness and social isolation were not highly correlated with one another (Coyle & Dugan 2012). Being alone or aloneness is not always viewed negatively by the individual. Solitude may be desirable and valuable for example to creativity, facilitating self-reflection, self-regulation, concentration, and learning (Luanaigh and Lawlor 2008; Rokach 2011). A person can be temporarily alone and not feel lonely as he or she feels highly connected with his or her spouse, family, and/or friends (Cacioppo et al. 2015). However, some people avoid solitude as it feels to them or reminds them of loneliness (Rokach 2011). On the other hand, one can feel lonely in the crowd or in a marriage (Cacioppo et al. 2015).

The experience of loneliness can be understood as a continuum, varying between “never feeling lonely” and “continuously feeling extremely lonely”. At some point in the continuum, the feeling of loneliness becomes disruptive. If prolonged, loneliness may impair the well-being of older people by increasing the risk for depression and impacting physical health for example through higher blood pressure, worse sleep, immune stress responses and worse cognition (Cacioppo et al. 2015). To differentiate normal from pathological loneliness, it is important to take the duration, frequency, and severity of the experience into account (Luanaigh & Lawlor 2008).

The relative importance of interpersonal needs may vary from person to person depending, for example, on age and life situation (Weiss 1974). However, the theory of social provisions does not adequately explain how the relative importance or experiences of the different dimensions of perceived togetherness change at different stages of life (Mancini & Blieszner 1992). The social needs of older persons may change and become more focused on affection, which is found in close relationships. The socio-emotional selectivity theory proposes that with the shortening of time, i.e., when a person knows or feels that there is not much time to live left, people focus on the social relationships that are emotionally most important to them (Carstensen 1992). Nevertheless, it appears that people’s social needs remain varied and focused on multiple social relationships and activities, even if these may become more difficult to satisfy (Steverink & Lindenberg 2006).

Factors related to social relationships, such as the death of a spouse, receiving fewer visits from friends, and having a less extensive social network, increase feelings of loneliness (Adams, Sanders & Auth 2004; Jakobsson & Hallberg 2005; Savikko et al. 2005; Routasalo et al. 2006; Victor & Bowling 2012; Smith 2012). However, the feeling of loneliness was not solely associated with the frequency of contacts with children and friends, but rather, as discussed above, with the expectations attached to these contacts and how far they were satisfied (Routasalo et al. 2006). An important predictor of loneliness is self-efficacy in social situations, which refers, for instance, to starting and maintaining a conversation (Cohen-Mansfield & Parpura-Gill 2007). In addition, health-related factors, such as poor health status, need of help with activities of daily

living, poor vision, loss of hearing, and depression predispose people to feelings of loneliness (Jakobsson & Hallberg 2005; Savikko et al. 2005; Routasalo et al. 2006; Victor & Bowling 2012; Smith 2012).

Assessment of perceived togetherness and loneliness. The theoretical model of social provisions proposed by Weiss' (1974) was subsequently operationalized by Cutrona and Russell (1987), who developed the Social Provisions Scale. Respondents are asked to rate the degree to which their social relationships currently supply attachment, social integration, guidance, reliable alliance, opportunity for nurturance, and reassurance of worth.

Loneliness can be assessed solely by asking people to rate their level of loneliness. The single question "Do you feel lonely?" is understandable and generally acceptable, and measures feelings of loneliness directly (Fees, Martin & Poon 1999). However, the nature and meaning of the concept "loneliness" may vary depending on the individual. In addition, a single question does not differentiate between emotional and social loneliness and whether loneliness is related more to the life situation or to personality characteristics of a person (Luanaigh & Lawlor 2008).

Several questionnaires exist that measure experiences of loneliness. The University of California Los Angeles (UCLA) Loneliness Scale was developed by Russell and colleagues to assess satisfaction with social relationships (see Russell et al. 1984). The scale items deal with the frequency and intensity of salient aspects of and events related to the experience of loneliness (Luanaigh & Lawlor 2008). The scale measures loneliness as a unitary phenomenon. The De Jong Gierveld Loneliness Scale can be used as a unidimensional loneliness scale, or as divided into the emotional and social subscales. The scale is based on the cognitive theoretical approach to loneliness which emphasizes the discrepancy between what person wants in term of interpersonal affection and intimacy and what he or she has (De Jong Gierveld & Van Tillburg 2006; De Jong Gierveld & Van Tillburg 2010).

2.2 Health decline with increasing age

Ageing changes the structure and functioning of most physiological systems, and thus increases vulnerability to diseases and death. Changes in the physiological systems of the body that accompany ageing are not always straightforwardly distinguishable from changes related to disease processes. Changes in the structure and functioning of physiological systems may lead to decline in functional ability and increased risk for morbidity. Functional ability includes mobility, activities of daily living, and instrumental activities of daily living (IADL). Activities of daily living describe abilities or difficulties in tasks related to self-care such as eating, toileting, bathing, and dressing. Instrumental activities in daily living describe abilities or difficulties in tasks such as preparing meals, shopping, cleaning, using public transportation, paying bills, etc. In addition to good physical functioning, managing in IADL also requires good cog-

nitive functioning. Decline in physical health causes challenges for the maintenance of mental health. However, such components of mental health as self-acceptance, environmental mastery, and experiencing purpose in life may be related to physiological functioning (see Ryff & Singer 2009) and help an older person to manage with physiological losses.

The World Health Organization (WHO) defines health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or injury” (WHO 1946). Health can be seen as a continuum. Thus, people living with a chronic disease may nevertheless perceive themselves as healthy or well, especially if they do not have pain or other severe symptoms which restrict their everyday life.

2.2.1 Physical health and ageing

Longer survival is generally related to a healthier life and thus *mortality* risk can be understood to be an indicator of health decline. It is important to distinguish between early predictors of mortality and immediate contributing causes of death. Causes of death refer to factors which are the immediate contributors to death. Predictors of mortality, in turn, refer to factors observed in earlier life which increase susceptibility to health decline and mortality. In this research, engagement in social activity was studied as a predictor of decreased mortality risk. Social activity includes life style factors which could be modifiable, and hence if promoted could prevent health decline. In general, mortality analyses are relatively straightforward, as death dates are registered with practically complete coverage. The mortality rate describes the frequency of deaths occurring in a population during a given time.

Institutionalization is an indicator of health decline. Moving to long-term care becomes probable when a person can no longer manage at home even with help from family members or home care providers. Risk for institutionalization is an indicator of the extent of the decline in health and functioning, but also of the level of availability of long-term care in the social and health care system. As a study outcome, it is more unstable than mortality as well criteria for institutionalization change over time, models of financing and organising social and health care differ between countries, while the need for institutionalization may also depend on the ability of a person’s social network to provide support and care. All these factors contribute to assessment of the risk for institutionalization in old age.

In Finland, the social and health care services underwent a structural reform in the 1990s, in favour of outpatient care. The number of recipients of informal care has since increased and long-term institutional care has been replaced by sheltered housing with individually tailored services (Kauppinen et al. 2003, 54, 65-70). In this research, the follow-up of long-term institutionalization ended in 2004; since then, the number of beds allocated for institutional care has further diminished (STM 2013, 70). This means that persons in long-term care and most of those living in service housing or who are recipients of home care services, need continuous or almost continuous care because of their

poor physical or cognitive health status. At the beginning of the millennium, long-term care in Finland was implemented in health centre inpatient wards and nursing homes. A participant is institutionalized if he or she has officially been deemed in need of long-term care. This decision is usually made by a physician when a period of care has lasted at least three months and the person continues to be in need of care (Kauppinen et al. 2003, 40). According to a meta-analysis by Gaugler and colleagues (2007), among the strongest predictors of nursing home admission were dependency in three or more daily activities, cognitive impairment, and prior nursing home use.

Mobility is a good health indicator as it captures the overall impact of chronic conditions (Guralnik et al. 1993), the effect of physiological changes (Guralnik et al. 1995; Rantanen et al. 2001), and lifestyle activities (Avlund, Vass & Hendriksen 2003; Fujita et al. 2006). Mobility refers to a person's ability to move independently from one place to another. It can be assessed either through self-report or through performance-based measures. Self-report measures often typically rate the subject's perceived difficulties, restrictions, or need for assistance associated with the activity. Maximal gait speed is an example of a performance-based indicator of mobility (Rantakokko, Manty & Rantanen 2013). Among older persons, walking and driving are most usual forms of mobility (Satariano et al. 2012).

2.2.2 Mental health and ageing

The concept of mental health can be used as an umbrella term for emotional, psychological, and social well-being and a low level of depression (Kokko et al. 2013). In this research, I have included cognitive functioning as a component of mental health. Emotional well-being includes life satisfaction and happiness as well as positive and negative mood (Diener 1984). Psychological well-being refers to self-acceptance, positive relations with others, environmental mastery, autonomy, purpose in life, and personal growth (Ryff & Keyes 1995). Mental health is more than the mere absence of mental illness, but not having mental health problems, for example depressive symptoms, form one component of this factor (Kokko et al. 2013).

Cognitive functions include for example perception, memory, perceptual speed, judgment, reasoning, and problem solving. Different cognitive functions or abilities have different developmental trajectories across the lifespan. Deterioration can be seen in the information processing speed due to the changes in brain and retardation in the central nervous system. In addition, working memory, episodic memory, and fluid abilities involving novel problem solving, reasoning, abstract thinking, and identifying complex relations among stimulus patterns, may decline as a part of normal ageing. However, differences between individuals are considerable. Many older adults retain high levels of cognitive function. Crystallized abilities, involving accumulated knowledge and expertise and reliance on long term memory, increase until old age (Ruoppila & Suutama 1997; Suutama 2004). Risk factors for cognitive ageing include age, low level of

education, the APOE genotype, diabetes, stroke, high LDL cholesterol, obesity, smoking, and physical inactivity (Haan & Wallace 2004).

Cognitive functioning is often measured by assessing difficulties in detection, apprehension, understanding, and remembering. The Mini-Mental State Examination, MMSE, is an often-used instrument to rate cognitive functioning among older people (Folstein, Folstein & McHugh 1975). The MMSE is a short test for rating a person's cognitive state and possible need for a more thorough examination of his or her cognitive capacities. The scale maximum is 30. Scores ranging between 24 and 30 describe normal or mildly impaired cognitive functioning, and a score of less than 21 indicates increased odds for dementia. The Mini-D test (Erkinjuntti et al. 1986) was developed for assessing essential cognitive functions such as orientation, memory and learning, reasoning, visualization, and problem-solving (Ruoppila & Suutama 1997; Takkinen & Ruoppila 2001). The Mini-D test comprises 35 items and the scale maximum is 43.

Depressive symptoms and melancholy may be adjustment reactions to negative life events such as bereavement or painful disease. Not all older people become depressed. With their inner mental resources and support from other people, they remain able to cope. In addition, older people may consider losses and difficulties as normative, i.e. as part of growing old. Melancholy, used in this research to describe level of melancholy or low spirits, is a person's current and general rating on his or her mood. It is theoretically possible to rate various depressive symptoms more accurately with validated questionnaires than by means of a single question. Depressive symptoms include depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor slowness, declined appetite, and difficulties in sleeping. Depressed mood or a clear loss of interest or enjoyment is a key symptom of depression (Greenberg 2007). Symptoms range from mild to severe. Criteria for a diagnosis of major depressive episode (DSM-IV-TR) are: persistently depressive mood; diminished ability to enjoy activities; feelings of worthlessness or excessive guilt; difficulty thinking and concentrating, indecisiveness; thoughts of death, suicidal ideation, attempts at suicide; excessive tiredness; significantly altered appetite and weight; too much or too little sleep; and psychomotor agitation or retardation. Depressive symptoms tend to shift with age from mood-related to being more somatic or vegetative (Schaakxs et al. 2017).

From 3 to 26 % of community-dwelling older adults reported clinically significant depressive symptoms (Greenberg 2007, referring to Hybels & Blazer 2003). Among Finnish community-dwelling 75-year-old persons, over one-third of women and one-quarter of men were depressed, with the proportion of depressed persons increasing, particularly among women, from age 80 to 85 years (Heikkinen & Kauppinen 2004). Across the lifespan, severity of depression has been found to be stable (Schaakxs et al. 2017). However, minor depression among older people is typically a dynamic and episodic phenomenon (Heikkinen & Kauppinen 2004).

Studies have found various factors to be related to depression or depressive symptoms in older people. In persons aged 85 or over, depression was

more common among women than among men (Kubzansky et al. 2005; Bergdahl et al. 2007). Factors related to social relationships such as lack of a friendly companion, fewer visiting neighbours, irritation with one's family, less participation in organized social activities and less church attendance, and grieving a recent loss were associated with depressive symptoms (Adams, Sanders & Auth 2004; Kaneko et al. 2007). Associations between loneliness and depressive symptoms have been found in cross-sectional (Alpass & Neville 2003; Barg et al. 2006; Bergdahl et al. 2007; Kaneko et al. 2007) and longitudinal studies (Heikkinen & Kauppinen 2004; Tiikkainen & Heikkinen 2005). On the other hand, poor subjective physical and mental health, medical illnesses, disability, poor vision, and sleep disturbances were observed to be associated with depressive symptoms among older persons (Adams, Sanders & Auth 2004; Heikkinen & Kauppinen 2004; Kubzansky et al. 2005; Kaneko et al. 2007). A personal history of depression and subsyndromal depression may predict late-life depression (Schoevers et al. 2006). In addition, perceived negative changes in life or current opinion that stress has a large impact on one's life were associated with depressive symptom (Heikkinen & Kauppinen 2004; Kaneko et al. 2007). Overall, depression is not a normal part of ageing, and should be detected and treated properly so that it does not become a prolonged state. Glass and colleagues (2006) refers to other studies pointing to the deleterious effects of depression. Depression has been found to be a risk factor for other negative health outcomes such as mortality, diminished immune function, and poor recovery from illness.

Assessment of mood. Depressive symptoms and depressive mood can only be assessed with self-reports. Questionnaires such as the Finnish version of the Beck Depression Inventory (BDI), the Geriatric Depression Scale (GDS), and the Center for Epidemiological Studies Depression Scale (CES-D) have been used to measure depressive symptoms. The BDI and CES-D were developed to observe, specify, and measure the intensity of depressive symptoms. In the CES-D, which comprises 20 questions, the weight is on depressive mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor slowness, declined appetite, and difficulties in sleeping. In addition to the symptoms mentioned in the CES-D, the BDI (21 questions) also includes symptoms or attitudes typical in depression, such as irritability, fatigue, inspection of one's health state, perceived appearance, difficulties in making decisions, feeling of punishment, self-hate, self-accusation, self-injuring, and lack of sexual interest. The original GDS questionnaire comprises 30 questions. The GDS-15 is based on the original GDS, and contains 15 dichotomized questions which have shown the strongest correlation with depressive symptoms (Kurlowicz & Greenberg 2007). The GDS has been found to be a good screening tool for depressive symptoms among older adults (e.g. de Craen, Heeren & Gussekloo 2003). In contrary to the BDI and CES-D, all the questions in the GDS relate to mood, rather than to the physical symptoms frequently reported by older adults (Greenberg 2007). Although Gana and colleagues (2016) suggested that depression, as assessed with the GDS, should be regarded as a relatively stable

and enduring trait construct, reflecting the stable core of a person's inclination toward depression, the GDS has been observed to detect changes in depressive symptoms. In a study among 85-year-old persons who had experienced a major negative life event, the shorter form of the GDS detected a change in their depressive symptoms (Vinkers et al. 2004). The meta-analysis by Pinquart and colleagues (2007) concluded that the GDS detected improvements in depressive symptoms.

2.3 Social engagement and health in old age

2.3.1 Social activity and decline in physical health

The association between social engagement and various health outcomes has been widely studied. Two broad aspects of the social relationships that have most frequently been studied in relation to health outcomes are the number of existing social relationships and the presence or amount of social support (Seeman & Crimmins 2001). In the late 1800s, Durkheim contributed to the study of the relationships and health by demonstrating the significance of the impact of social embeddedness on suicide risk (Seeman & Crimmins 2001). In 1953, Havighurst and Albrecht (Lemon, Bengtson & Peterson 1972 referring to Havighurst and Albrecht 1953) made the first explicit statement concerning the importance of social role participation in positive adjustment to old age. Followed by other research, evidence increased for the observation that activity in general, and specifically interpersonal activity, seems to be consistently important for predicting an individual's sense of well-being in later years (Lemon, Bengtson & Peterson 1972). Throughout the 1970s and 1980s epidemiologic and demographic research showed that a lack of social ties or social network predicted *mortality* (Berkman et al. 2000). These studies most often included data on the number of close friends and relatives, marital status, and membership of religious and voluntary associations.

In her review, Seeman (1996) concluded that in addition to social relationships, the quality of existing ties, i.e. provision of social support or detrimental aspects of relationships, appears to influence the extent of health benefits. Meta-analyses showed that the existence of and interconnections between diverse social ties as well as individuals' positive experiences within social relationships significantly decreased mortality risk (Holt-Lunstad, Smith & Layton 2010). On the other hand, social isolation and loneliness increased the likelihood of mortality (Luo et al. 2012; Holt-Lunstad et al. 2015). These results remained consistent across gender, length of follow-up, and world region. However, Holt-Lunstad and colleagues (2015) suggested that the salutary effects of being socially connected may be stronger than the adverse effects of lacking connections. Interestingly, Antonucci and his colleagues (2010) found that positive relationship quality with spouse, child, or best friend was not whereas negative relationship quality with child and friend, but not spouse, was associated with de-

creased mortality. It is possible that negative quality relationships may enhance cognitive health, and be a sign of a very close relationship and greater and more complex engagement among older adults, thereby leading to improved survival.

A considerable body of empirical evidence shows that social participation decreases risk for mortality (Moen, Dempster-McClain & Williams Jr 1989; Steinbach 1992; Sabin 1993; Yasuda et al. 1997; Dalgard & Lund Haheim 1998; Glass et al. 1999; Walter-Ginzburg et al. 2002; Hyyppa et al. 2007; Steptoe et al. 2013). For example, more active participation in activities occurring in a social context, e.g. church attendance, going to cultural and sporting events, playing games, and participation in social groups, decreased mortality risk in a 13-years follow-up among people aged 65 years and over (Glass et al. 1999). Psychosocial group intervention decreased mortality risk among older lonely people (Pitkälä et al. 2009). However, in the study by Rodriguez-Laso and colleagues (2007), participation in social activities was not associated with mortality risk. Participation in productive activities including e.g. volunteering (Glass et al. 1999; Han et al. 2017) or helping others with specific tasks such as transportation (Brown et al. 2003; Han et al. 2017) decreased the risk for mortality.

Time spent with friends was significantly related to increased survival (Maier & Klumb 2005). Friendship ties may reduce mortality risk because they are based on some element of choice, and thereby reflect a sense of personal control (Litwin 2007) and prevent loneliness, a risk factor for increased mortality risk (Penninx et al. 1997; Holwerda et al. 2012; Holt-Lunstad et al. 2015). In addition, mortality risk was lower among older adults who received more emotional support (Penninx et al. 1997) or had greater feelings of usefulness (Gruenewald et al. 2007; Gruenewald et al. 2009) and older women who experienced emotional closeness, social integration, reassurance of worth, and opportunity for nurturance (Lyyra & Heikkinen 2006).

Very few studies have investigated social activity as a predictor of *institutionalization*. Steinbach (1992) reported that participation in social activities decreased the risk for institutionalization in people aged 70 years or over. The structural characteristics of a person's social network may also predict institutionalization. For example, living alone increases, and being married decreases, the risk for nursing home placement (Miller & Weissert 2000; Gaugler et al. 2007).

Results from longitudinal studies have shown that more frequent participation in social activities decreases the risk for developing *mobility* disability, which refers to need for help in mobility tasks, among older persons (Avlund et al. 2004; James et al. 2011) and older men (Avlund, Vass & Hendriksen 2003). Mendes de Leon and colleagues (2003) found both a strong cross-sectional association between higher social activity and need of help with fewer mobility tasks, and that the longitudinal protective effect of social activity diminished slowly over time. Thus, it is possible that participation in social activities helps maintenance of mobility in older people. Studies on the consequences of collective and productive social activities separately are rare, but it is conceivable that each type of activity includes physical stimulation and thus enhances mobility

in older people. Mobility impairments, in turn, predict mortality risk (Guralnik & Ferrucci 2003; Hirvensalo, Rantanen & Heikkinen 2000).

On the other hand, it is possible that better mobility is a prerequisite for participating in social activities. In general, the onset of health problems was a major reason for reduction in social participation in old age (Bukov, Maas & Lampert 2002). Although previous participation in leisure activities predicts late-life participation patterns, impaired mobility may lead to giving up habitual activities (Agahi, Ahacic & Parker 2006).

2.3.2 Social activity and cognitive functioning

The “use it or lose it” hypothesis of cognitive ageing predicts that, by exercising cognitive abilities in various environments, engagement in physical, social, and intellectual activities prevents their deterioration (Bielak 2010 referring Salthouse). Higher levels of social activity predicted better cognitive functioning in older people (Bassuk, Glass & Berkman 1999; Zunzunegui et al. 2003; Barnes et al. 2004; Fratiglioni, Paillard-Borg & Winblad 2004; Beland et al. 2005; Krueger et al. 2009) and older women (Tomioka, Kurumatani & Hosoi 2016), although this has not been found in all studies (Aartsen et al. 2002). Cognition of lonely older people was improved by psychosocial group intervention (Pitkälä et al. 2011). Engagement with others may offer cognitive stimulation through navigating social cues, engaging new activities, dealing with complex and sometimes challenging social issues, or provide support, promote well-being, and decrease stress. Activities that cross domains may be most protective against cognitive decline. In addition, an important aspect of activity is the amount of novelty it offers (Bielak 2010). Cognitive impairment, in turn, has been found to predict mortality risk in old age (Lavery et al. 2009; Sampson, Bulpitt & Fletcher 2009; Wilson et al. 2009).

It is conceivable that cognitive functioning is a prerequisite for participating in social activities. There is some evidence that cognitive decline may affect the social network. Aartsen and colleagues (2004) found that cognitive decline was associated with loss of relationships, most likely friends and neighbours, and that relationships with family members compensated for these, but only if the network was small. Impaired cognition may lead to giving up leisure activities (Agahi, Ahacic & Parker 2006).

2.3.3 Social engagement and depressive symptoms

Earlier studies have shown that depressive symptoms are more common among people who participate less in social activities (Adams, Sanders & Auth 2004). Longitudinally, higher social participation and interaction with friends prevented depressive symptoms among those not depressed at baseline. However, social participation did not promote recovery among those who were depressed (Glass et al. 2006; Wahrendorf et al. 2008; Min, Ailshire & Crimmins 2016). Nonetheless, Isaac and colleagues (2009) found that participation in social activities explained improvement in depressive symptoms.

Of the dimensions of perceived togetherness, a higher level of reassurance of worth, attachment, guidance, and reliable alliance have been found to explain lower number of depressive symptoms in cross-sectional (Tiikkainen & Heikkinen 2005) and a higher level of reliable alliance and reassurance of worth in longitudinal settings with older people (Russell & Cutrona 1991). Glass and colleagues (2006) suggest that social engagement may constitute or be a marker for active coping strategies that may lower the risk of depression. In times of health deterioration or other negative life events, perceived or anticipated support may be important in maintaining mental well-being (Cutrona, Russell & Rose 1986). Results of Taylor and Lynch (2004) showed that the possibility of an older person to count on at least some family or friends for support provided a buffer against the effect of disability on depressive symptoms. In addition, higher perceived reliable alliance and guidance, referring advice and assistance, were related to subsequent mental health in cases when an older person encountered negative life events (Cutrona, Russell & Rose 1986).

2.4 Alleviating loneliness and depressive mood by promoting social engagement among older people

Interventions aiming to alleviate loneliness and depressive mood can be divided into selective or indicated prevention (Schoevers et al. 2006). Selective prevention is aimed at people who are exposed to certain risk factors, for instance, those experiencing spousal loss and physical illness. Indicated prevention, on the other hand, targets people who already have early or subsyndromal symptoms, for whom an intervention may reduce the likelihood of developing a full-blown case of depression. Although observational studies have shown that the incidence of depressive symptoms is lower among people involved in social activity (Glass et al. 2006; Wahrendorf et al. 2008), intervention studies suggest that alleviating loneliness and depressive symptoms in older people may not be as straightforward as the observational studies suggest. In a systematic review conducted by Dickens and colleagues (2011), only three out of twelve group interventions with a control group were effective in reducing loneliness and three out of eight were effective in alleviating depression. However, in their meta-analysis, Masi and colleagues (2011) found that interventions to reduce loneliness were effective in the nonrandomized group comparison studies, of which 14 out of 18 focused on individuals aged 60 years and over, and in studies with a randomized group comparison design, of which 10 out of 20 focused on individuals aged 60 years and over.

Previous systematic reviews have concluded that interventions that were effective in decreasing loneliness were typically conducted in a group setting, included some form of educational or training input and social activity, and involved active participation (Cattan et al. 2005; Dickens et al. 2011). For older

women living alone, discussion on health-related topics reduced their feelings of loneliness (Anderson 1985). A group intervention focusing on self-management abilities attenuated social loneliness in older women (Kremers et al. 2006). A group-based educational, cognitive, and social support intervention program was successful in decreasing loneliness and in increasing subjective well-being among older persons who had relocated within 2 years (Saito, Kai & Takizawa 2012). The intervention aimed to prevent social isolation by improving community knowledge and networking with other participants and various community facilitators who connect the participants with community services. Participants had plenty of opportunities during the program to evaluate their relocation experiences by conversing with their fellow participants in a supportive atmosphere. Masi and colleagues (2011) found, in contrast to the results of systematic reviews, that the interventions that were the most successful in reducing loneliness addressed maladaptive social cognition rather than aiming at improving social skills, enhancing social support, and increasing opportunities for social contacts. When addressing maladaptive social cognition individuals are educated to identify the automatic negative thoughts that they have about others and about social interactions and to take for these negative thoughts as possibly faulty hypotheses that need to be verified rather than as facts on which to act (see Cacioppo et al. 2015). In addition, group-based interventions were no more effective than individual-based interventions, although the authors stressed that this may be due to selection bias (Masi et al. 2011).

Reminiscence and life review have been reported to be potentially effective methods for the enhancement of psychological well-being (Bohlmeijer et al. 2007), and for treating depressive symptoms in older adults (Bohlmeijer, Smit & Cuijpers 2003). A group-based exercise training program was more effective than individual home exercise in improving mood in older women (Timonen et al. 2002). A group intervention including 1) therapeutic writing and group psychotherapy, 2) physical exercise and discussion, or 3) art activities, increased psychological well-being in older participants suffering from loneliness (Routasalo et al. 2009). A meta-analysis of randomized controlled trials in people aged 60 years and over (Pinquart, Duberstein & Lyness 2007) concluded that all the interventions studied, irrespective of their form, produced significant improvements in depressive symptoms. Effect sizes were larger for cognitive and behavioural therapy and reminiscence, and medium for psychodynamic therapy, psychoeducation, physical exercise, and supportive interventions. The results of another meta-analysis (Forsman, Nordmyr & Wahlbeck 2011) showed that psychosocial interventions had a small improvement on quality of life and positive mental health among intervention participants of older adults. Interventions with 7–12 sessions may optimize effectiveness while minimizing drop-out rates (Pinquart, Duberstein & Lyness 2007).

The causes of loneliness and depressive symptoms are likely to be unique to the individual. Two remedial approaches are commonly applied: situational and characterological. The situational approach focuses on the defects of relationally inadequate social environments and suggests modifications of life pat-

terns that might make a richer social world available, or alternatively, supplement the existing social environment. The characterological approach directs our attention to the defects in motivation or skills that leave individuals vulnerable to undesired loneliness and suggests therapy or education as remedial programs (Weiss 1973, 73). Interventions that promote coping with a broad range of age-related stressors and rebuilding positive activities (e.g. cognitive-behavioural therapy) may be more efficacious than interventions that focus on just a single factor (Pinquart, Duberstein & Lyness 2007). Whereas individual treatment allows for adapting the topic and methods to the individual needs, group interventions can help build supportive social networks utilizing peer support. For physically and cognitively impaired patients, modifications in treatment format and/or content might be useful, such as combining psychotherapy with social work interventions and pharmacotherapy (Cacioppo et al. 2015; Pinquart, Duberstein & Lyness 2007). Persons with less severe depressive symptoms and loneliness may be more likely to benefit from a therapy-induced increase in their abilities to cope with stressors and strains. Masi and colleagues (2011) suggest that improvements in interventions are needed, if clinically significant improvements in reducing loneliness are to be achieved.

2.5 The study framework

I used the conceptual model proposed by Berkman and her colleagues (2000) for parsing and inserting the different social and health-related variables of my research in the model template (Figure 1). Social engagement, including collective and productive social activity and perceived togetherness, is one psychosocial mechanism through which social networks impact health. Collective and productive social activities represent different dimensions of social activity as the resources people give when participating in these activities, their orientation toward the activities, and the needs met by participating in them all differ. Furthermore, based on the earlier literature, I expected collective and productive social activities to be associated with risk for adverse health outcomes such as mortality and institutionalization. However, the effect of these two dimensions of social activity on the risk for health outcomes may vary, as the different social needs they satisfy may affect this risk through distinct pathways. There is a need for more thorough understanding how the various types of social activities may contribute to better health.

The conceptual model of Berkman and colleagues (2000) posits that social networks further impact health through the pathways most proximate to the health outcome, i.e., the health behaviour, physiological, and psychological pathways. In this research, I have restricted my focus to physiological and psychological pathways and used the model as a framework when adding variables into the pathways. Berkman and her colleagues include, for instance, allostatic load, immune systems functions, cardiovascular reactivity, and cardio-pulmonary fitness in the physiological pathway. In this study, mobility has

been included in the physiological pathway as mobility is a good health indicator and its decline captures the overall impact of chronic conditions (Guralnik et al. 1993) and the effect of physiological changes (Guralnik et al. 1995; Rantanen et al. 2001). According to the model, the psychological pathway involves self-efficacy, self-esteem, coping effectiveness, depression or distress, and sense of well-being. Based on earlier studies, I expected participation in social activities to maintain better mobility and cognitive functions, and to prevent an increase in depressive symptoms; and better mobility, cognitive functioning, and fewer depressive symptoms, in turn, to decrease mortality risk. On the other hand, it is possible that better mobility and cognitive functioning and having lower number of depressive symptoms are prerequisites for participating in social activities. Thus, there is a need to study whether mobility, cognitive functioning and depressive symptoms are potential mediators between social activity and mortality risk, or whether they alternatively should be considered as prerequisites for social activity among older people.

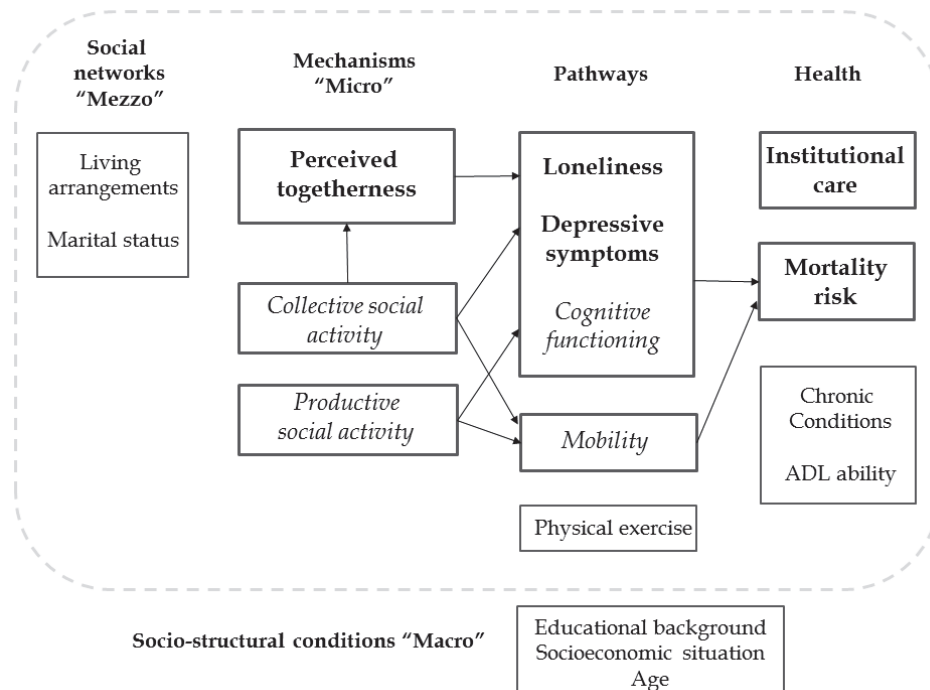


FIGURE 1 Outline of the variables used in this study based on a parse of the conceptual model constructed by Berkman and colleagues (2000).

Note: Socio-structural conditions "macro", social networks "mezzo", mechanisms "micro", and pathways are taken directly from the conceptual model of Berkman and colleagues.

Note: Variables in bold were used as outcomes in this dissertation research, variables in italics were used as main explanatory variables or as mediators, and variables in normal font were used as co-variates in the analyses.

Perceived togetherness describes peoples' experiences of their social relationships. The theory of social provisions (Weiss 1973, 17; Weiss 1974) and earlier studies proposes that experiences of social relationships, which are qualitative in nature, are essential for not having feelings of loneliness and for alleviating depressive symptoms. However, the theory of social provisions and earlier literature do not adequately show whether all or only some of the dimensions of perceived togetherness are associated with loneliness and depressive symptoms among older people. In addition, studies on the longitudinal association between perceived togetherness, loneliness, and depressive symptoms are needed in order to better understand the phenomenon. In addition, existing knowledge of the interventions aiming to alleviate loneliness and depressive symptoms in older people include more or less conflicting findings, and they suggest that alleviating loneliness and depressive symptoms in older people may not be as straightforward as the observational studies propose. However, based on earlier literature, I expected an increase in collective social activity to alleviate feelings of loneliness and depressive symptoms and increase experiences of perceived togetherness.

3 PURPOSE OF THE RESEARCH

The purpose of this research was to investigate the role of social activity and perceived togetherness in health decline among older people. Also investigated were potential mediators in these associations.

Specifically, the research questions were:

1. Does collective and productive social activity decrease risk for mortality and institutionalization? (Study I).
2. Do mobility, cognitive functioning, and depressive symptoms operate as mediators in the association between collective and productive social activity and mortality risk, or should they be considered as prerequisites for social activity? (Study II).
3. Do the dimensions of perceived togetherness, such as social integration, attachment, guidance, reliable alliance, opportunity for nurturance, and reassurance of worth explain loneliness and depressive symptoms in older community-dwelling people? (Study III).
4. Does a social intervention of choice affect depressive symptoms, melancholy, feelings of loneliness, and the dimensions of perceived togetherness in older community-dwelling people? (Study IV).

4 PARTICIPANTS AND METHODS

4.1 Study designs and participants

The four studies that comprise this dissertation are based on two research projects. The study designs and datasets are summarized in Table 1.

TABLE 1 Summary of study designs and populations.

Dataset	Study	Design	Participants	Age, years (mean±sd)
Evergreen	I	Observational 17-year follow-up for mortality 16 y follow-up for institutionalization	n=1 181	65-84 (72.9 ± 5.4)
Evergreen	II	Observational 21-year follow-up for mortality	n=1 181 Men n=406 Women n=775	65-84 (72.9 ± 5.4)
GoodMood	III	Observational Exploratory longitudinal 6-month follow-up	n=222 Intervention group n=104 Control group n=118	75-79 (77.0 ± 1.4)
GoodMood	IV	Experimental Randomized control trial 6-month intervention 12-month post-intervention follow-ups	n=223 Intervention group n=105 Control group n=118	75-79 (77.0 ± 1.4)

Two of the studies are based on the Evergreen project, which was launched in 1988 and is a multidisciplinary, prospective, observational population-based study on the health and functional capacity of older residents in the City of Jyväskylä, Finland. The Evergreen project was conducted in close co-operation with the City of Jyväskylä. The third and the fourth studies are based on data derived from the GoodMood (Promotion of mental well-being in older people)

project (ISRCTN 78426775) which was launched in 2008 and was a single-blinded randomized control trial lasting 1.5 years. The research aim was to investigate the effects of a social intervention on depressive mood and loneliness in older community-dwelling older people who reported loneliness, melancholy, or depressive mood. GoodMood was carried out in co-operation with the GeroCenter Foundation for Research and Development, University of Jyväskylä, JAMK University of Applied Sciences, and the City of Jyväskylä, Finland.

4.1.1 The Evergreen project (Studies I and II)

The study protocol of the Evergreen project has been described in detail by Heikkinen (1998). The study population consisted of people born between 1904 and 1923 who were resident in the city of Jyväskylä, Finland in 1988. Of this group, 1 600 persons were randomly sampled for recruitment into the study, with oversampling of those aged 75 years or older at baseline. Of these people, 36 persons had died between the sampling and beginning of the baseline study, 33 had been placed in a nursing home or hospital before the interview and 5 had moved. Of the remaining individuals, 1 224 took part in the baseline interview in 1988. Reasons for non-participation (n=302) included unwillingness to participate in the study (n=158), health problems (n=57), and other reasons (n=60), or the person was not reached (n=27). I excluded the 21 persons who died during 1988, less than one year from baseline, from the analyses as the closeness of death could have influenced the measurements. I also excluded the 22 persons who had a large amount of missing data in their baseline questionnaire. Thus, our analyses were based on 1 181 individuals, comprising 406 men and 775 women.

The data used in this dissertation consisted of face-to-face interviews on health, functioning, and living habits at baseline as long with a 16-year follow-up for institutionalization and 21-year follow-up for mortality. Interviews were carried out in participants' homes. Dates of death were obtained from the Finnish Population register and dates of long-term care decisions from the local registers of health care centres and nursing homes. All participants had complete follow-up data on vital status and institutionalization. For the baseline variables, 62 % had complete data. Among the 38 % of the study participants with missing baseline values, the mean of the proportion of missing values was 13 percent.

4.1.2 Promotion of mental well-being in older people - GoodMood project (Studies III and IV)

The sampling procedure and study design are shown in Figure 2. The target population comprised of all the 75- to 79-year-old residents living in the central area of the city of Jyväskylä, Central Finland, in August 2008 (N=1 167). This age group can be considered suitable for screening as their health issues are unlikely to be severe enough to restrict participation, while a substantial proportion will be at risk for loneliness or depressive mood. Contact

information was gathered from the Finnish population register. Of the original target population of 1 167 people, information on perceived loneliness and melancholy was obtained for 985 persons via phone screening. The inclusion criteria were: (a) reported feelings of loneliness, melancholy, or depressive mood at least sometimes, (b) scoring higher than 21 in the Mini-Mental State Examination, which indicates the criterion for participation, and (c) willingness to participate in the study. These criteria were met by 296 persons, of whom 39 withdrew from the study before randomization. After a detailed structured face-to-face home interview between September and November 2008, the participants met a counsellor once. The meeting included discussion of the participant's life situation and available social support. After completion of the screening and data collection process, 257 persons were allocated to the intervention or control groups, using a randomized ratio of 1:1, by drawing lots. The trial administrator performed the randomization. Interviewers and data collection assistants were blinded to the group assignment of the participants throughout the study.

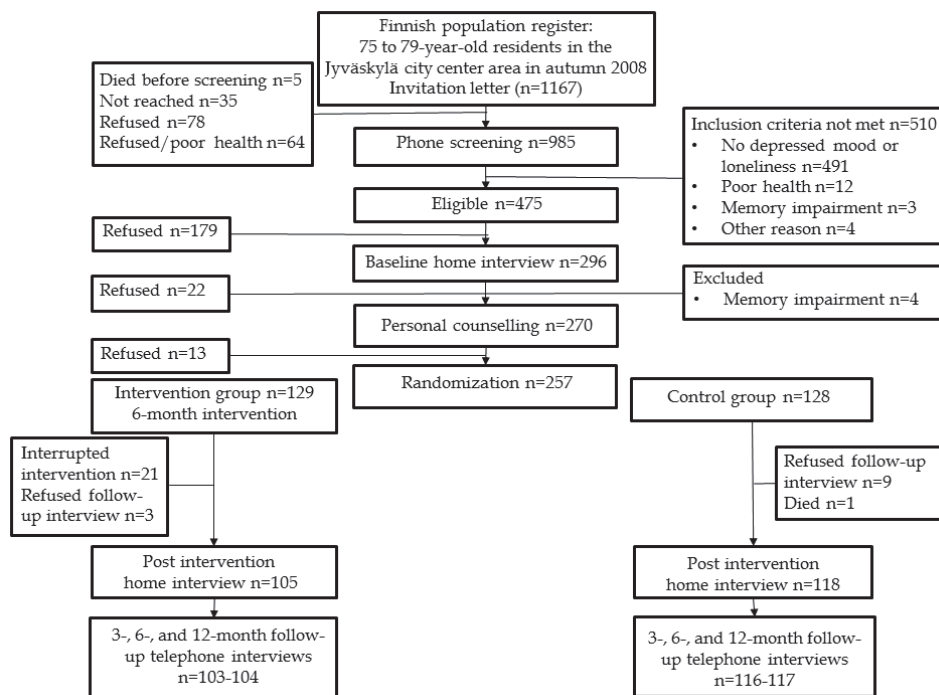


FIGURE 2 Flow of the GoodMood study.

At the end of the 6-month intervention, between April and June, 2009, a follow-up face-to-face interview was conducted in the participants' homes. Shorter follow-up interviews were conducted by phone at 3, 6 and 12 months after intervention end. One participant died and 33 withdrew from the study during the intervention. Only data on the persons who participated in both home

interviews were analysed (n=222–223). One participant was excluded from the follow-up, as the interviewer reported that the replies given were not valid due to adverse mental state. Thus, in study III, the social intervention group comprised 104 and the self-directed control group 118 participants. Depressive symptoms and perceived togetherness were assessed at baseline and at the end of the 6-month intervention, and melancholy and feelings of loneliness were further assessed at the 3-, 6-, and 12- month post-intervention follow-up measurements.

Dropouts did not differ in sex, self-rated health, or melancholy from those who remained in the study. A slightly larger proportion of those who continued participation vs. dropped out lived alone (66 vs. 56 %), felt lonely at least sometimes (68 vs. 52 %), and did not have a supporting person in their network (22 vs. 13 %). At each stage, the reasons most often given for withdrawal were lack of interest (24 %), no expected benefit from participation (27 %), lack of time (28 %), and poor health (27 %).

4.2 Ethics

The Evergreen and GoodMood projects were conducted according to the tenets of good scientific practice laid down in the Declaration of Helsinki. The face-to-face interviews were conducted by trained interviewers. In all phases of the research, privacy and data protection were ensured. The Evergreen project was conducted in co-operation with the City of Jyväskylä. The GoodMood project was approved by the Ethical Committee of the Central Finland Health Care District. All participants gave their informed consent prior to the study.

4.3 Register-based data

4.3.1 Dates of death

In the Evergreen project, dates of death, obtained from the population register, included all the deaths that occurred between January 1988 and February 2005 in study I, and between January 1988 and December 2009 in study II. *Survival time* was calculated as the number of days from the baseline interview date to either the date of death or the end of the follow-up period (February 8th 2005) in study I, and from January 1st 1988 to either the date of death or the end of the follow-up period (December 14th 2009) in study II. Survival times were censored at the end of the follow-up. Time to death was used as outcome measures in studies I and II.

4.3.2 Dates of long-term care decisions

In the Evergreen project, data on long-term care decisions were drawn from the local registers of health care centres and nursing homes. *Time to the long-term care decision* was calculated as the number of days from the baseline interview date to either the date of the long-term care decision, the date of death, or the end of the follow-up period (December 31st 2004). Time to long-term care was used as the outcome measure in study I.

4.4 Measurements

4.4.1 Social activity

In the Evergreen project, social activities were elicited at baseline in a structured interview. To assess *collective social activity*, participants were asked about their involvement in different leisure time activities, such as cultural events (visiting the theatre, going to concerts or movies, etc.), artistic hobbies (singing, playing a musical instrument, painting, etc.), being active in organizations, involvement in congregational activities, and taking study classes. The response options were regularly, occasionally, or not at all. For dancing, the frequency of participation was categorised as at least once a month, less than once a month, or not at all. For physical activity pursued in a group, frequency of participation was categorised as at least once a week, once or twice a month or less, or not at all. For domestic and foreign travel, the response options were a few times a year, once a year or less, or not at all.

To assess *productive social activity* the participants were asked about their involvement in giving help to relatives, friends, or neighbours in cooking, shopping, child caring, cleaning, going for a walk, laundry, going to the bank or post office, or in doing some other activity. Frequency was categorised as at least once a month, less than once a month, or not at all.

For each activity variable, the option most frequently engaged in was scored as 2, the second most frequently engaged in as 1, and the third most frequently engaged in as 0. In study I, sum scores for collective social and productive social activities were calculated. In study II, following the validation of the two-factor structure of the social activity data by using exploratory factor analysis, confirmatory factor analyses were used to formulate latent factors for collective and productive social activities. Sum scores or latent factors of collective and productive social activities were used as explanatory variables in studies I and II.

4.4.2 Loneliness and perceived togetherness

In the GoodMood project (III, IV), *loneliness* was assessed with the question: "Do you feel lonely?" The response options were "very rarely or never", "some-

times", and "often or almost always". Loneliness was used as the outcome variable in studies III and IV.

Dimensions of perceived togetherness were measured using the Social Provisions Scale developed on the basis of Weiss's theory (Cutrona & Russell 1987). Its 24 items are equally divided between the six different dimensions: attachment, social integration, guidance, reliable alliance, opportunity for nurturance, and reassurance of worth. Two of the four questions in each dimension are positively and two negatively worded. On a scale from "strongly disagree" (scored 1) to "strongly agree" (scored 4), the respondents were asked to assess to what extent they thought each statement described their current social relationships. Example items are *attachment*: "I do not have a feeling of closeness with anyone"; *social integration*: "there are people who like the same social activities I do"; *guidance*: "there is no one I feel comfortable talking about problems with"; *reliable alliance*: "there are people I know will help me if I really need it"; *opportunity for nurturance*: "I feel responsible for taking care of someone else"; and *reassurance of worth*: "there are people who value my skills and abilities". The responses to the negatively worded items were reversed. A sum score was calculated for each dimension with scores ranging between 4 and 16, where larger values indicate a more positive situation. The dimensions of perceived togetherness were used both as explanatory and outcome variables in study III, and as an outcome variable in study IV.

4.4.3 Depressive mood

In the Evergreen project (I, II), *depressive symptoms* were assessed using the Revised Beck's Depression Inquiry (RBDI) (Lampinen et al. 2006 referring to Raitasalo 1995) which is a modified version of Beck's Depression Scale (Beck, Rial & Rickels 1974). The RBDI correlates strongly with original Beck's Depression Scale, both measuring perceived depressive symptoms (Lampinen et al. 2006 referring to Raitasalo 1995). Every item is rated 0-3, and higher scores indicate greater severity of symptoms. In the RBDI, the maximum score is 39.

In the GoodMood project (III, IV), depressive symptoms were measured using a short form of the Geriatric Depression Scale (GDS-15). The GDS is specially designed to screen for depressed mood in older adults (see Greenberg 2007). A larger score indicates greater severity of symptoms and the scale maximum is 15. The cut-off score for depression has most commonly been defined as ≥ 5 (Greenberg 2007). In all the analyses, sum scores were used.

In the GoodMood project, *melancholy* was assessed with the question: "How do you perceive your mood in general?" The response options were "almost always good", "sometimes melancholy", and "often or almost always melancholy". Depressive symptoms were used as an adjusting variable in study I, as a mediator in study II, as an explanatory and an outcome variable in study III, and as an outcome variable in study IV. Melancholy was used as an outcome variable in study IV.

4.4.4 Cognitive functioning

In the Evergreen project (I, II), cognitive functioning was measured with the Mini-D test (Erkinjuntti et al. 1986). The test can be used to assess essential cognitive functions such as orientation, memory and learning, reasoning, visualization, and problem-solving (Takkinen & Ruoppila 2001). The Mini-D test comprises 35 items and the scale maximum is 43.

In the GoodMood project (III, IV), cognitive functioning was assessed with the Mini-Mental State Examination, MMSE, (Folstein, Folstein & McHugh 1975). The MMSE is a short test for rating the cognitive state of a person and a screening tool for a more thorough examination. The scale maximum is 30 and a score of less than 21 corresponds to increased odds for dementia. Sum scores were used for both tests. In both tests, a larger score indicates better cognitive functioning. Cognitive functioning was used as an adjusting variable in study I, as a mediator in study II, and as descriptive background variable in studies III and IV.

4.4.5 Mobility

In the Evergreen project (I, II), mobility was measured by asking about ambulating indoors, outdoors, and climbing stairs. The response options for these were categorized as “yes, without difficulties” (scored 0), “yes, but has difficulties” (scored 1), or “not able/needs somebody to help” (scored 2). A sum score was computed, with a larger score indicating more difficulties in mobility.

In the GoodMood project (III, IV), mobility was assessed by asking about perceived difficulties in walking 2 km, 500 m, ambulating indoors, and climbing stairs. The response options for these were “not able” (scored 0), “not able without somebody to help” (scored 1), “yes, but has difficulties” (scored 2), or “yes, without difficulties” (scored 3). The measure of mobility was computed as the sum of the four perceived difficulty items. Mobility was used as an adjusting variable in studies I and III, as a mediator in study II, and as descriptive background variable in study IV.

4.4.6 Other adjusting and background variables

Data on demographic and socioeconomic factors, living habits, and other health related information were collected at baseline and at follow-up in face-to-face interviews. The covariates used for adjustment in statistical models included age (in years) (I, II), full-time education (in years) (I, II), perceived economic situation (a 5-point scale from very good to very poor) (I), marital status (married or cohabiting vs. single, widowed, divorced) (I), living alone (no/yes) (III), intensity of physical activity (I), morbidity (I, II), and the ability to perform essential self-care tasks (I).

Intensity of physical exercise was measured on a 7-point scale from “moving about only minimally to carry out everyday chores” to “engaging in competitive sports several times a week” (Hirvensalo, Lintunen & Rantanen 2000).

The variable distribution was concentrated at three points of the distribution and, hence, it was re-categorized as follows: “moving about only minimally to carry out everyday chores”, “light physical activity one to two or several times a week”, and “exercise causing breathlessness and sweating at least one to two times a week”.

Morbidity was assessed by asking the participant to state all physician-diagnosed chronic diseases of more than three months' duration. Diseases were subsequently classified by a physician according to the ICD-9. Number of the following diseases was used in the analyses: ischemic heart disease, cardiac insufficiency, heart infarction, cerebral infarction, chronic obstructive pulmonary disease (I, II), and diabetes, other cardiovascular diseases, epilepsy, Parkinson's disease, paralysis, muscular skeletal diseases, and mental disorders (II).

The ability to perform essential self-care tasks was measured by asking if a person had difficulties in eating, getting in or out of bed, dressing, bathing, and toileting. The response options for these were categorized as “yes, without difficulties”, scored 0, “yes, but has difficulties”, scored 1, or “not able/needs somebody to help”, scored 2. A sum score was computed for difficulties in self-care tasks by adding the scores together.

In studies III and IV, age, sex, full-time education (level of schooling), perceived economic situation (good, moderate, or poor), morbidity, and activities outside home (not at all, a few times a year, 1-3 times per month, at least weekly) were used as descriptive background variables.

4.5 Social intervention

In the GoodMood project, the participants randomized to the intervention group were allowed to select the intervention regime they thought would benefit them the most: supervised exercise in a group (selected by 45 participants), personal counselling (selected by 33 participants), and a social activity program (selected by 27 participants) (Table 2). Each regime included social interaction and participants were able to influence the content of the meetings. From theoretical perspective, all the intervention regimes can be counted as examples of collective social activity. Participants got together with other participants or a counsellor, acted together, conversed, and thus the interaction enabled thoughts and experiences to be shared.

The exercise and social activity programs were held once a week and 19-21 times in total during the intervention. The exercise program involved varying types of exercise and was conducted by qualified instructors in municipal gyms. The social activity program was delivered by health care students from JAMK University of Applied Sciences and participants met in the city library. Activities included group discussions, receiving visitors and being given information on health-related topics, self-expression using art and creative methods, and going on day-trips. The personal counselling was conducted by a rehabilitation counsellor, and meetings took place in a health care center. Meetings

were held approximately every third week and each participant attended 4–5 meetings. The issues discussed in the meetings varied depending on what topics the participant considered important. Counselling was given when needed.

The self-directed control group received one counselling session, which included discussion of the participant's life situation and available social support and the services offered by municipality and other service providers. Thus, the social intervention group received more social attention and activity than the self-directed group.

TABLE 2 Number of participants and content of subgroup programs of the 6-month intervention in the GoodMood project.

Intervention regime	n	Number of meetings	Frequency/length of meetings	Content of regime
Exercise program (three groups)	45	19–21	Once a week/one hour	Varied types of exercise, e.g. circuit training, training with step board or rubber band, planned with the participants. Aims were to exercise together, gain familiarity with various types of exercise, and enhance balance, muscle strength, and movement of joints.
Social activity program (two groups)	27	20–21	Once a week/two hour	Discussion in groups, using art and creative methods, exposure to aesthetic experiences, day-trips. The focus was on sharing experiences and thoughts, and acquiring information on health-related topics.
Personal counselling	33	In most cases, 4–5 times per participant	Every third week/one hour	Discussion on topics important to a participant, and counselling using a solution-focused method. Focus on listening, appreciation of the person's experiences and goals, person's responsibility for his or her own well-being, and positive attitude and coping skills of the participant.

4.6 Statistical analyses

Baseline comparison of the differences in means of the continuous measurements between non-survivors and survivors and non-institutionalized, deceased, and surviving participants were performed using the Mann-Whitney *U* test and Kruskal-Wallis test. For the dichotomous variables, the chi-square test was used (I). All tests were performed as two-tailed with SPSS software with a significance level set at $p < .05$. A mortality rate was calculated for men and women by dividing the number of outcomes by the sum of follow-up person-years, and was expressed as number of deaths per 100 person-years (II).

A proportional hazard model and competing risk model (I)

A proportional hazard regression model (Cox 1972) was used to estimate whether collective and productive social activities predicted time to mortality. Competing risks models (Fine & Gray 1999) were used to analyse time to institutionalization, which is an extension of the proportional hazards model and enabled focus on the sub-distribution of risk for institutionalization and mortality risk to be treated as an adjusting outcome. Sex was taken into account by allowing baseline hazard to vary by sex, as significant differences in baseline hazards for sex in mortality risk were observed in the preliminary analyses. A hierarchical set of models were built for both outcomes by adding one set of the baseline indicators of sociodemographics, psychological and physiological health, and physical activity at a time to assess whether they might account for possible associations between social activity, mortality, and institutionalization.

Relative reduction in risk was reported as a percentage. For both models, checks on the assumption of the proportionality of hazards were performed and a plotting technique based on Schoenfeld-residuals was used to investigate time-dependent effects (Grambsch & Therneau 1994). Residual checks for the functional form of covariates and influential observations were also performed (Therneau & Grambsch 2000). Analyses were performed with R version 2.11.0 (R Development Core Team. 2010).

Latent variable models (II)

Latent variable models were used to investigate the possible pathways between social activity, mobility, cognitive functioning, depressive symptoms, and mortality risk. First, the confirmatory factor analysis was used to assess the paired associations of the social activity factors (latent variables) on mobility, cognitive functioning, and depressive symptoms. Second, the effects of mobility, cognitive functioning, depressive symptoms, and social activity on mortality risk were tested by using proportional hazards models adapted for the factor variables. Third, the proportional hazards models were extended to mediator models to investigate pathways between the (collective and productive) social activity factors and mortality risk with mobility, cognitive functioning, and depressive symptoms as possible mediators in the main hypothesized model, and also in competing models, including one with mobility, cognitive functioning, and depressive symptoms as prerequisites for the social activity dimensions. Models were conducted separately for men and women as the likelihood ratio test in two-group analyses for men and women showed that both the factor structure and the mediating effects differed by sexes.

Since the models were non-nested, they were compared using three standard information criteria: Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample-size adjusted BIC (aBIC). The AIC-based evidence ratio (Burnham & Anderson 2004) was also used to assess the probability of information loss related to using a less well fitting model on the data. In the latent variable models, mortality risk was adjusted for age, education,

and chronic diseases. The analyses were performed with MPLUS version 5.21 (Muthén & Muthén 1998-2009).

Cross-lagged modelling (III)

Cross-lagged modelling was used to estimate associations between the studied variables. The weighted least square estimator (WLSMV) was used to obtain parameter estimates. The dimensions of perceived togetherness, loneliness, and depressive symptoms at baseline were adjusted for baseline status of living alone and baseline perceived difficulties in mobility. In the follow-up situation, the studied variables were adjusted for baseline living situation and follow-up perceived difficulties in mobility. When the cross-sectional direction was set from depressive symptoms to loneliness, the estimates of the root mean square error of approximation (RMSEA), a measure of model fit, were smaller than when the direction was set in the opposite direction. Thus, models with the cross-sectional direction from depressive symptom to loneliness fitted the data better than those with the direction from loneliness to depressive symptoms. The correlation between the different dimensions of perceived togetherness varied between 0.44–0.71 at baseline and 0.39–0.88 at follow-up in the social intervention group and between 0.34 –0.77 at baseline and 0.24 –0.75 at follow-up in the self-directed control group. To avoid multicollinearity owing to the correlations, the different dimensions of perceived togetherness were analysed in separate models.

The social intervention group received more social attention and activity than the self-directed reference group. Thus, we first built the models estimating the associations between the variables separately for the social intervention and self-directed group. Each association was then tested for group equality using the likelihood ratio test (LRT). Where the LRT showed significant worsening of model fit for group equality, path coefficients and 95 % confidence intervals are shown separately for the social intervention group (upper values in the figures) and self-directed control group (lower values in the figures). The analyses were performed with MPLUS version 5.21 (Muthén & Muthén 1998-2009).

Generalized estimating equations models (IV)

Generalized estimating equations (GEE) models were used to estimate parameters for group- and time -main effects and group-by-time interaction for depressive symptoms, melancholy, loneliness, and the dimensions of perceived togetherness. I report *p*-values for type III effect as they are invariant to the choice of reference category. In the main analyses, the three intervention subgroups were analysed as a single group to optimize statistical power relative to the control group. Ancillary GEE analysis for the intervention subgroups and for those above and below the GDS cut-off score (≥ 5) were conducted. The analyses were performed with IBM SPSS Statistics, version 22.0.

Data imputation (I-IV)

In the Evergreen project, among the 38 % of the study participants with some missing baseline values, the mean of the proportion of missing values was 13 percent. In the GoodMood project, the proportion of missing data for individual variables varied between 0 and 3.6 %. The Multiple Imputation (MI) procedure of SAS for Windows (version 9.1) was used to impute missing values using the available information from the model variables and on background characteristics, physical activity, and health-related variables. SAS was used for imputation of missing values as I wanted to use model-external variables as part of the imputation process. In the imputation, available information for example on sociodemographic factors; physical and cognitive health and functional capacity; social relationships and social participation; and depressive symptoms and quality of life was used. In lack of comparative simulation studies confirming superiority of any imputation software, SAS was selected as the imputation program because of long-standing acknowledged reputation in mathematically-oriented statistical analysis, state-of-the-art of implementation of imputation algorithms, and demonstrated quality of imputation results.

5 RESULTS

5.1 Characteristics of the participants

Table 3 summarizes the baseline characteristics of the participants in the Evergreen and the GoodMood studies. Mean participant age in the Evergreen study at baseline was 72.9 years, 66 % were women, 45 % were married, and 46 % lived alone. In cognitive functioning (Mini-D), the mean score was 36.3 and the mean number of chronic diseases was 2.0. Approximately 40 % of participants reported difficulties in at least one mobility task, and 27 % had at least mild depression. No mobility problems were reported by 69 % of men and 56 % of women. The mean in the Mini-D test was 36.4 for men and 36.2 for women. The mean in the Revised Beck's Depression Inquiry was 2.7 for men and 3.6 for women.

TABLE 3 Baseline characteristics of participants in the Evergreen and GoodMood data sets.

	Evergreen project (n=1 181)	GoodMood project (n=223)
	Mean (sd)	Mean (sd)
Age (in years)	72.9 (5.40)	77.0 (1.43)
Number of chronic illnesses	2.0 (1.52)	2.9 (1.61)
Cognitive functioning ^a	36.3 (5.23)	27.2 (2.07)
	%	%
Women	65.6	75.3
Married or cohabitated	44.6	35.8
Lives alone	45.6	65.0
Difficulties in mobility ^b	39.6	39.9
Depressive symptoms ^c	27.4	31.4

Note: ^a=Mini-D test scores ranged between 0 and 43 and Mini Mental State Examination scores between 0 and 30. ^b=Difficulties at least in one mobility task. ^c= ≥ 5 in the Revised Beck's Depression Inquiry and ≥ 5 in the Geriatric Depression Scale.

In the GoodMood data, mean participant age was 77.0 years at baseline, 75 % were women, 36 % were married, and 65 % lived alone. In cognitive functioning (MMSE), the mean score was 27.2 and the mean number of chronic diseases was 2.9. Approximately 40 % of participants reported difficulties in at least one mobility task, and 31 % had at least mild depression.

5.2 Collective and productive social activity of the participants (Study I and II)

Percentages of participation in social activities, factor loadings in confirmatory factor analysis and coefficients of determination for collective and productive social activity (II) are shown in Table 4 for 65- to 84-year-old men and women separately. Among both men and women, attending cultural events, artistic hobbies, organizational participation, studying, travelling, dancing, and physical activity pursued in groups formed a latent variable describing collective social activity. Helping others in cooking, shopping, child care, cleaning, going for a walk, washing clothes, going to the bank or post office, and helping in some other way formed a latent variable describing productive social activity.

When calculated using the sum score of the variables included in collective and productive social activities, respectively, mean (standard deviation; range) collective social activity was 4.70 (2.95; 0-18) and mean productive social activity 1.48 (2.38; 0-16) (I). In general, collective social activity was more common than productive social activity, as only 6 percent of the participants did not participate in any collective social activity at all, compared to 55 percent for productive social activity.

As can be seen from Table 4, one in every four participants took regularly part in organizational activities and one in every five women in congregational activities. Attendance at cultural events, such as theatres, movies and concerts, and engagement in artistic hobbies, such as singing in a choir, painting, etc., are equally common as regular activities among both sexes. The highest regular participation rate was for domestic travel. Of the productive social activities studied, the most commonly engaged in by men were helping with shopping and cleaning, and by women, helping with shopping, cooking, and child care. The factor correlation between the social activity factors was moderate (see Table 4).

TABLE 4 Proportion of participation in social activities, standardized factor loadings for confirmatory factor analysis, 95 % confidence intervals and coefficient of determination (R^2) for social activity factors, and factor correlations in men (n=406) and women (n=775).

	Men					Women				
	Participation, %		Factor loading	95% CI	R^2	Participation, %		Factor loading	95% CI	R^2
	Reg. ¹	Occas. ²				Reg. ¹	Occas. ²			
Collective social activity										
Attending cultural event	9	46	0.759	0.66, 0.86	0.58	11	49	0.697	0.62, 0.77	0.49
Studying	7	3	0.669	0.51, 0.83	0.45	4	3	0.526	0.38, 0.67	0.28
Travelling in home country	70	18	0.665	0.54, 0.79	0.44	64	21	0.683	0.60, 0.77	0.47
Travelling abroad	14	39	0.537	0.41, 0.66	0.29	12	36	0.654	0.58, 0.73	0.43
Organizational participation	27	15	0.535	0.41, 0.66	0.29	24	10	0.596	0.51, 0.68	0.36
Dancing	8	16	0.553	0.43, 0.68	0.31	4	7	0.690	0.58, 0.80	0.48
Artistic hobbies	13	9	0.440	0.27, 0.61	0.19	10	6	0.459	0.35, 0.57	0.21
Physical activity pursued in groups	7	3	0.281	0.08, 0.48	0.08	10	2	0.420	0.28, 0.56	0.18
Congregational activities	7	9	0.137	-0.03, 0.31	0.02	20	13	0.061	-0.03, 0.15	0.00
Productive social activity										
Helping in shopping	13	7	0.906	0.84, 0.97	0.82	9	7	0.825	0.71, 0.94	0.68
Helping in washing clothes	3	3	0.885	0.80, 0.97	0.78	5	3	0.880	0.77, 1.00	0.77
Helping in going bank, post office, etc.	8	7	0.852	0.78, 0.93	0.73	4	5	0.763	0.64, 0.89	0.58
Helping in cleaning	11	6	0.848	0.76, 0.93	0.72	6	2	0.907	0.80, 1.02	0.82
Helping in cooking	7	4	0.821	0.72, 0.92	0.67	9	5	0.745	0.63, 0.86	0.55
Helping in going for a walk	2	2	0.556	0.32, 0.79	0.31	6	4	0.570	0.44, 0.70	0.33
Helping in child care	7	7	0.394	0.23, 0.56	0.16	8	9	0.308	0.18, 0.44	0.10
Helping in some other way	3	11	0.352	0.20, 0.51	0.12	3	8	0.251	0.11, 0.40	0.06
Correlation between factors			0.345	0.20, 0.49				0.270	0.15, 0.40	

¹: Refers to *regular* participation in cultural events, study classes, organizational activities, artistic hobbies, and congregational activities; travelling at least few times a year in home country and abroad; participating in physical activities pursued in groups at least once a week; and dancing and helping other people at least once a month. ²: Refers to *occasional* participation in cultural events, study classes, organizational activities, artistic hobbies, and congregational activities; travelling once a year or less in home country and abroad; participation in physical activities pursued in groups less than once or twice a week; and dancing and helping other people less than once a month. Remaining proportion = "no participation".

5.3 Associations between social activity and risk for mortality and institutionalization (Study I)

At the 17-year follow-up of mortality, 834 persons (71 %) had died. At the 16-year follow-up of institutionalization, 262 persons (22 %) were institutionalized and 605 persons (51 %) had died without first being institutionalized. Those not institutionalized or deceased during the follow-up time were more active in participating in collective social and productive social activities, were younger, had longer education, and evaluated different dimensions of their health as good compared to those institutionalized or deceased during the follow-up. Mean perceived economic situation was not associated with institutionalization or mortality status at end of follow-up. A slightly larger proportion of the institutionalized participants were women than the overall proportion of women in the entire cohort and a slightly larger proportion of the deceased participants were men than the overall proportion of men in the entire cohort. People who were married or cohabitating were less likely to have been institutionalized or to have died by the end of the follow-up. Those participating in physical activities were less likely to have been institutionalized or to have died during the follow-up.

The results of the proportional hazard regression analyses revealed that both collective and productive social activity were associated with reduced mortality risk when the model was controlled for age and the baseline hazard was allowed to vary by sex (Model 1, Table 5). A unit -increase in collective social activity lowered mortality risk by 8 percent and productive social activity by 4 percent. Adjusting the raw model for marital status, education, and perceived economic situation (Model 2), indicators of psychological and physiological health (Model 3), or intensity of physical activity (Model 4) did not change the effect of collective social activity on mortality risk. However, productive social activity was no longer a significant predictor of decreased mortality risk after adjusting the model for number of serious illnesses, difficulties in self-care tasks and mobility, cognitive functioning, and depressive symptoms (Model 3 and 5). Collective social activity was related to lower mortality risk even after inclusion of all the adjusting covariates (Model 5): a unit increase in collective social activity lowered mortality risk by 4 percent. Because 17 years is a relatively long follow-up time, it is reasonable to consider whether the baseline social activity measures influenced the mortality risk throughout the follow-up period. Tests of the proportionality assumption showed that neither the effect of collective ($p = 0.088$) nor the effect of productive ($p = 0.342$) social activity on mortality risk was time-dependent. Thus, I conclude that the influence of collective social activity remained statistically stable over time in the models for mortality risk.

In the initial models, time-dependence was not controlled for, and I observed no significant association in any of the hierarchical competing risks models (full-model HR 1.03; 95 % CI 0.98-1.08) between collective social activity

and risk for institutionalization when mortality risk was also controlled for. However, the proportionality test on the influence of collective social activity on risk for institutionalization indicated that it was time-dependent ($p < 0.001$). When the interaction of each of the two categories of social activity with follow-up time was controlled for, collective social activity had a significant main effect on risk for institutionalization whereas productive social activity did not. At the beginning of the follow-up (at time 0 days) a unit-increase in collective social activity lowered institutionalization risk by 30 percent when controlled for age (Model 1, Table 6). At this early follow-up time, collective social activity was associated with risk for institutionalization even when other covariates were added into the base model. In the full adjusted model, a unit-increase in collective social activity lowered the initial risk for institutionalization by 27 percent (Model 5).

TABLE 5 Hierarchical models of the association between social activity and 17-year **mortality** risk among 65- to 84-year-old people: Hazard ratios (HR) and 95 % confidence intervals (CI) (n = 1 181).

	Model 1	Model 2	Model 3	Model 4	Model 5
	HR (95 % CI)	HR (95 % CI)	HR (95 % CI)	HR (95 % CI)	HR (95 % CI)
Participation in collective social activities	0.93 (0.91-0.95)	0.93 (0.91-0.95)	0.96 (0.93-0.98)	0.95 (0.92-0.97)	0.96 (0.94-0.99)
Participation in productive social activities	0.96 (0.93-0.99)	0.96 (0.93-0.99)	0.98 (0.95-1.02)	0.96 (0.94-1.00)	0.99 (0.95-1.02)
Age (in years)	1.11 (1.10-1.13)	1.11 (1.10-1.13)	1.09 (1.08-1.11)	1.11 (1.09-1.12)	1.09 (1.08-1.11)
Marital status (married vs. no married)		0.91 (0.78-1.07)			0.94 (0.80-1.10)
Education		1.04 (0.90-1.21)			1.12 (0.96-1.30)
Perceived economic situation		1.07 (0.97-1.17)			1.00 (0.90-1.10)
Number of serious illnesses			1.22 (1.10-1.37)		1.23 (1.10-1.37)
Number of difficulties in self-care			0.97 (0.90-1.06)		0.98 (0.90-1.06)
Number of difficulties in mobility			1.22 (1.14-1.30)		1.19 (1.10-1.27)
Cognitive functioning			0.97 (0.96-0.99)		0.97 (0.96-0.98)
Depressive symptoms			1.00 (0.98-1.03)		1.00 (0.98-1.02)
Intensity of physical exercise					
-light physical activity vs. only performance of everyday chores				0.75 (0.64-0.88)	0.87 (0.73-1.03)
- exercise causing breathlessness and sweating at least 1-2x/week vs. only performance of everyday chores				0.58 (0.46-0.74)	0.71 (0.55-0.92)

TABLE 6 Hierarchical models of the association between social activity and 16-year mortality-adjusted **institutionalization** among 65- to 84-year-old people: Hazard ratios (HR) and 95 % confidence intervals (CI) (n = 1 181).

	Model 1	Model 2	Model 3	Model 4	Model 5
	HR (95 % CI)	HR (95 % CI)	HR (95 % CI)	HR (95 % CI)	HR (95 % CI)
Participation in collective social activities	0.77 (0.69-0.85)	0.77 (0.69-0.85)	0.79 (0.71-0.89)	0.77 (0.69-0.86)	0.79 (0.71-0.88)
Interaction: time*collective social activity	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Participation in productive social activities	0.94 (0.88-1.01)	0.94 (0.89-1.01)	0.95 (0.89-1.02)	0.95 (0.89-1.01)	0.95 (0.89-1.02)
Age (in years)	1.09 (1.06-1.11)	1.07 (1.50-1.10)	1.07 (1.05-1.10)	1.09 (1.06-1.11)	1.06 (1.04-1.09)
Marital status (married vs. no married)		0.55 (0.42-0.73)			0.55 (0.42-0.73)
Education		0.89 (0.68-1.17)			1.03 (0.78-1.37)
Perceived economic situation		1.03 (0.87-1.22)			1.04 (0.87-1.24)
Number of serious illnesses			0.95 (0.76-1.19)		0.94 (0.75-1.18)
Number of difficulties in self-care			1.13 (0.99-1.29)		1.13 (0.99-1.29)
Number of difficulties in mobility			0.98 (0.85-1.13)		0.96 (0.83-1.12)
Cognitive functioning			0.96 (0.93-0.98)		0.96 (0.93-0.98)
Depressive symptoms			0.99 (0.95-1.03)		0.98 (0.94-1.02)
Intensity of physical exercise					
-light physical activity vs. only performance of everyday chores				1.03 (0.77-1.39)	1.05 (0.75-1.47)
- exercise causing breathlessness and sweating at least 1-2x/week vs. only performance of everyday chores				0.82 (0.54-1.26)	0.90 (0.57-1.44)

Testing the interaction with time indicated that the effect of collective social activity on risk for institutionalization changed over time (interaction coefficient of collective social activity and time $b = 0.000077$, $s.e. (b) = 0.000014$, $p < 0.001$). To illustrate the change over time of the effect of collective social activity, Figure 3 shows the analysis of time-dependency in the form of Schoenfeld-type residuals against time, where we also plotted a LOESS curve with 95 % confidence intervals to aid in interpretation. The figure shows that at baseline and up to about 2500 days (about 6.8 years) into follow-up the regression coefficient of collective social activity is significant and negative, indicating a protective effect of collective social activity. After this, the risk begins to rise, the LOESS curve exhibiting a slightly increasing slope up to the end of the follow-up period. Thus, after about 4 000 days (about 11 years) into follow-up risk for institutionalization increased for those collectively active at baseline. Removing the outliers with residuals larger than the absolute value of five did not materially change the results. Based on the model of Table 6, we calculated that, when the other covariate values were held at their means (continuous variables) or zero (discrete variables), the hazard estimates for institutionalization at 1000, 3250 and 5500 days were 0.85, 1.01 and 1.19, respectively.

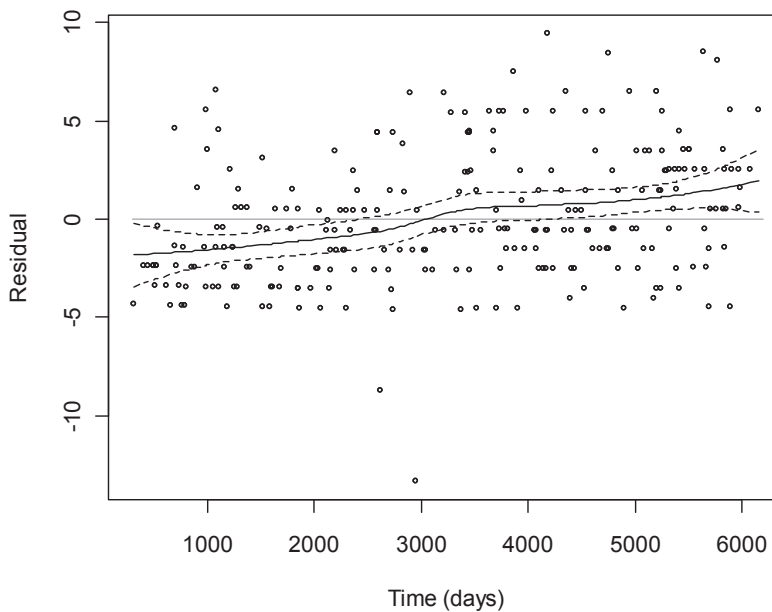


FIGURE 3 Assessment of time-dependence with Schoenfeld-type residuals plotted against time for collective social activity in the competing risks model for institutionalization. The solid black line is a LOESS fit line, the horizontal grey line indicates the zero value for the regression coefficient and the dashed lines refer to the 95 % confidence intervals of the LOESS fit line.

5.4 Mobility, cognitive functions, and depressive symptoms as mediators in the association between social activity and mortality risk of older people (Study II)

Among men, 89 % died during 21-year follow-up, yielding a mortality rate of 7.9 deaths per 100 person-years. Collective social activity correlated with mortality and with mobility, cognitive functioning, and depressive symptoms all of which, in turn, also correlated with mortality (Table 7). Productive social activity also correlated with mortality, mobility, and cognitive functioning, but not with depressive symptoms. In the full path model, controlled for age, education, and number of chronic diseases, mobility and cognitive functioning mediated the effect of collective and productive social activity on mortality risk (Figure 4). There was also a statistically significant direct effect of collective social activity on mortality risk. No mediating effect was observed for depressive symptoms.

Among women, 81 % died during the follow-up, yielding a mortality rate of 6.4 deaths per 100 person-years. The results of the preliminary analyses for women were comparable to the results obtained for men except that productive social activity was also correlated with depressive symptoms, but not with cognitive functioning (Table 7). The results of the full pathway model for women were comparable to the results for men except that no mediating effect was observed for cognitive functioning (Figure 5).

Comparing all the information criteria showed that the competing models fitted better to the data than the mediating model (in Figures 4 and 5). Models based on information criteria indicated that the likelihood that any one of the models other than the competing models in Figures 6 and 7 would more efficiently minimize information loss was less than 0.001, indicating that these competing models were clearly the best fitting models to the data. This was the case in both men and women.

In the competing model among men, the results showed that good cognitive functioning was a prerequisite for collective and productive social activities (Figure 6). A lower number of depressive symptoms was a prerequisite for participating in collective social activities. Mobility functioned as a mediator between social activity factors and mortality risk. Among women, the results were comparable to those obtained for men except that lower number of depressive symptoms was a prerequisite also for productive social activity (Figure 7). An independent effect of collective social activity on mortality risk remained among both sexes.

TABLE 7 Unstandardized bivariate path coefficients (est.) and 95 % confidence intervals (CI) between social activity factors, mortality, mobility, cognitive functioning, and depressive symptoms among men (n=406) and women (n=775).

	Mortality		Mobility		Cognitive functioning		Depressive symptoms		Collective social activity		Productive social activity	
	Est.	95 % CI	Est.	95 % CI	Est.	95 % CI	Est.	95 % CI	Est.	95 % CI	Est.	95 % CI
Men												
CSA	-0.49	-0.78, -0.21	-0.79	-1.32, -0.26	2.46	0.97, 3.95	-1.67	-2.67, -0.66	-	-	-	-
PSA	-0.06	-0.13, -0.00	-0.27	-0.45, -0.09	0.46	0.09, 0.83	-0.00	-0.20, 0.19	-	-	-	-
Mobility	0.43	0.32, 0.53	-	-	-	-	-	-	-0.38	-0.59, -0.17	-1.12	-1.68, -0.55
Cognitive func.	-0.07	-0.09, -0.04	-	-	-	-	-	-	0.08	0.04, 0.12	0.16	0.08, 0.25
Depr. sympt.	0.08	0.05, 0.11	-	-	-	-	-	-	-0.11	-0.18, -0.05	-0.12	-0.23, -0.01
Women												
CSA	-0.38	-0.57, -0.20	-1.03	-1.49, -0.56	2.80	1.90, 3.70	-1.17	-1.71, -0.63	-	-	-	-
PSA	-0.10	-0.17, -0.02	-0.37	-0.58, -0.16	0.16	-0.11, 0.43	-0.35	-0.58, -0.11	-	-	-	-
Mobility	0.40	0.31, 0.48	-	-	-	-	-	-	-0.41	-0.55, -0.27	-0.72	-1.00, -0.44
Cognitive func.	-0.06	-0.08, -0.04	-	-	-	-	-	-	0.10	0.07, 0.14	0.08	0.11, 0.58
Depr. sympt.	0.05	0.02, 0.07	-	-	-	-	-	-	-0.09	-0.13, -0.05	-0.15	-0.23, -0.08

Note: CSA = Collective social activity, PSA = Productive social activity. Estimates in bold are statistically significant values.

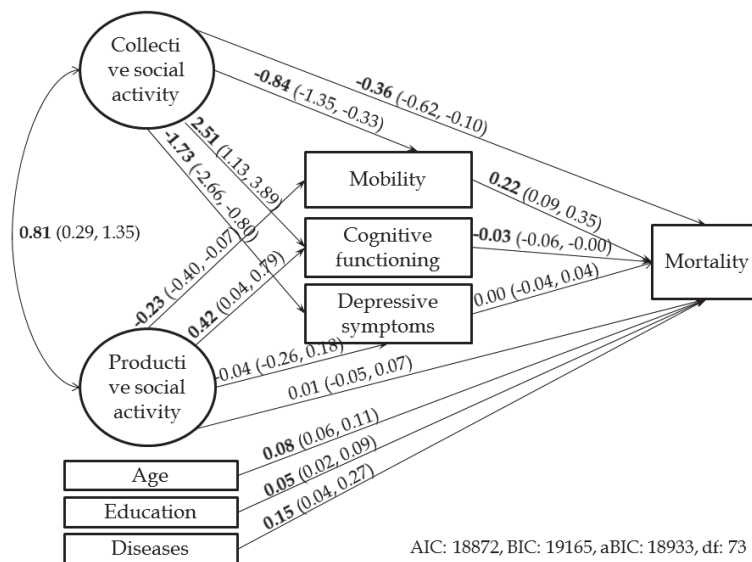


FIGURE 4 Unstandardized path coefficients (95 % confidence intervals) of latent factor mediator model for social activity factors, mobility, cognitive functioning, depressive symptoms, and mortality risk among **men** (n=406). AIC: Akaike information criterion, BIC: Bayesian information criterion; aBIC: sample-size adjusted BIC, where $n^* = (n + 2) / 24$, *df*: number of free parameters in the model. Estimates in bold are statistically significant values.

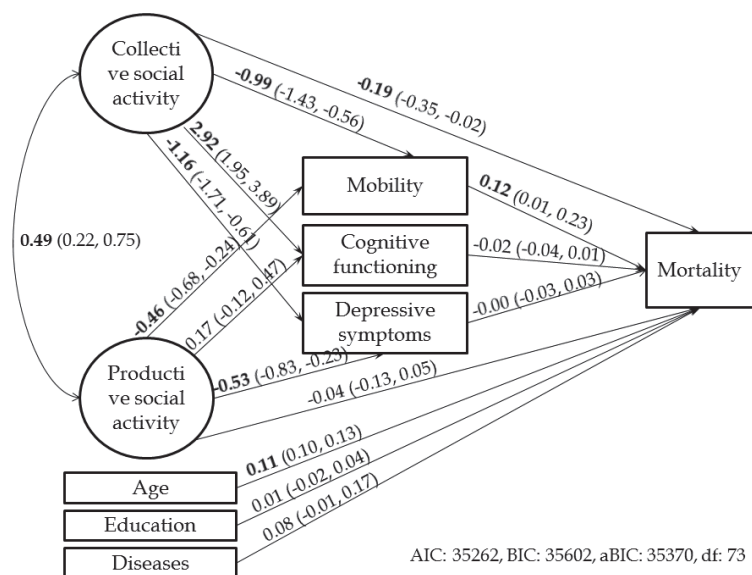


FIGURE 5 Unstandardized path coefficients (95 % confidence intervals) of latent factor mediator model for social activity factors, mobility, cognitive functioning, depressive symptoms, and mortality risk among **women** (n=775).

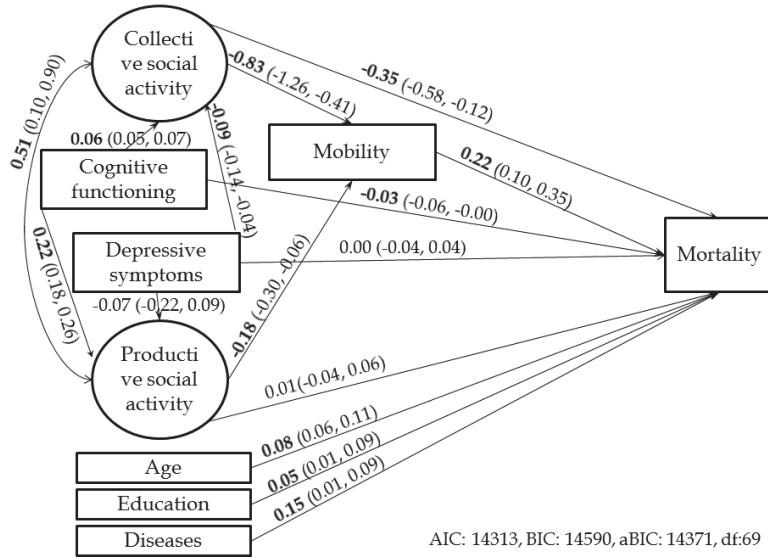


FIGURE 6 Unstandardized path coefficients (95 % confidence intervals) of latent factor competing model for cognitive functioning, depressive symptoms, social activity factors, mobility, and mortality risk among **men** (n=406).

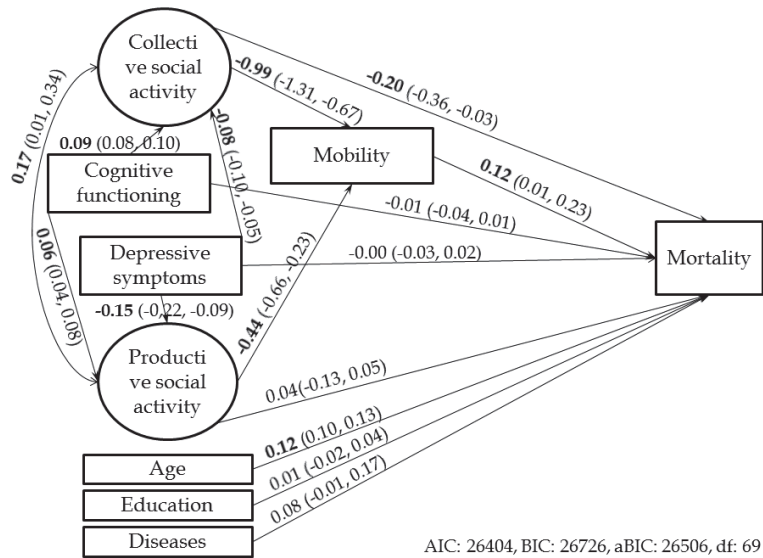


FIGURE 7 Unstandardized path coefficients (95 % confidence intervals) of latent factor competing model for cognitive functioning, depressive symptoms, social activity factors, mobility, and mortality risk among **women** (n=775).

5.5 Associations between the dimensions of perceived togetherness, depressive symptoms, and feeling of loneliness (Study III)

The mean number of depressive symptoms was 3.6, and 31 % of participants had at least mild depression ($GDS \geq 5$) (Table 8; see also Table 9). Two-thirds of the participants reported experiencing loneliness at least sometimes at baseline and one-half at follow-up. Experiences of perceived togetherness were highest in guidance and reliable alliance, and lowest in reassurance of worth and opportunity for nurturance at both baseline and follow-up. No significant differences were observed between the groups in the studied variables either at baseline or follow-up.

TABLE 8 Means (standard deviations) and proportions of characteristics of participants in the GoodMood project at baseline and at the six-month follow-up (n=222).

	Baseline	Follow-up
	Mean (sd)	Mean (sd)
Depressive symptoms	3.6 (2.45)	3.5 (2.68)
Social integration	12.5 (2.16)	12.9 (2.05)
Attachment	12.3 (2.42)	12.9 (2.23)
Guidance	12.8 (2.47)	13.4 (2.05)
Reliable alliance	13.1 (2.53)	13.3 (2.04)
Opportunity for nurturance	11.8 (2.53)	11.9 (2.64)
Reassurance of worth	11.7 (2.03)	12.0 (1.84)
Loneliness	%	%
-no/very rarely	31.5	50.9
-sometimes	54.5	37.8
-often or continuously	14.0	11.3

The baseline and follow-up values of the dimensions of perceived togetherness, depressive symptoms, and loneliness correlated statistically significantly. After controlling for the previous measurements of each studied variable, the analyses revealed only a few cross-lagged links from the dimensions of perceived togetherness to depressive symptoms. A higher level of attachment in all participants and opportunity for nurturance in the social intervention group at baseline predicted a lower number of depressive symptoms at follow-up (Figures 8, 12). No cross-lagged associations were observed between the dimensions of perceived togetherness at baseline and loneliness at follow-up.

However, several cross-lagged associations were observed between baseline loneliness and depressive symptoms and the follow-up dimension of perceived togetherness. Lower feelings of loneliness at baseline predicted more experiences of social integration, guidance, and alliance at follow-up (Figures 9–11). Fewer depressive symptoms at baseline preceded higher perceived attach-

ment, social integration, guidance, and reassurance of worth at follow-up (Figures 8–10, 13).

In addition to cross-lagged associations, cross-sectional associations between the dimensions of perceived togetherness and depressive symptoms and feelings of loneliness were observed. At baseline, higher perceived attachment, guidance, and reliable alliance were related to a lower level of loneliness (Figures 8, 10–11). At follow-up, higher perceived attachment and opportunity for nurturance were associated with a lower level of loneliness (Figures 8, 12). All the dimensions of perceived togetherness were associated with fewer depressive symptoms at baseline, and all, except for attachment, at follow-up (Figures 8–13). In general, the cross-sectional associations between the variables in the groups were similar. However, the groups differed in that higher perceived opportunity for giving nurturance at baseline was related to fewer depressive symptoms at follow-up in the social intervention group. In addition, at follow-up, higher perceived social integration, guidance, and reliable alliance were associated with fewer depressive symptoms, but only in the social intervention group.

Of the variables adjusted for, living alone was associated with a higher level of loneliness at baseline in all models. Living alone was also associated with a lower level of attachment. Living alone and perceived difficulties in mobility were associated with a lower level of opportunity for nurturance at baseline. At follow-up, perceived difficulties in mobility were related to depressive symptoms.

All the cross-lagged models fitted the data well. In the models in which attachment, guidance, and reliable alliance were analysed as potential explanatory factors for depressive symptoms and loneliness, the CFI values were 1.000 and RMSEA values less than 0.0005. In the model for social integration, the CFI value was 1.000 and RMSEA 0.004. For reassurance of worth, the respective values were 0.970 and 0.055, and for opportunity for nurturance 0.995 and 0.022.

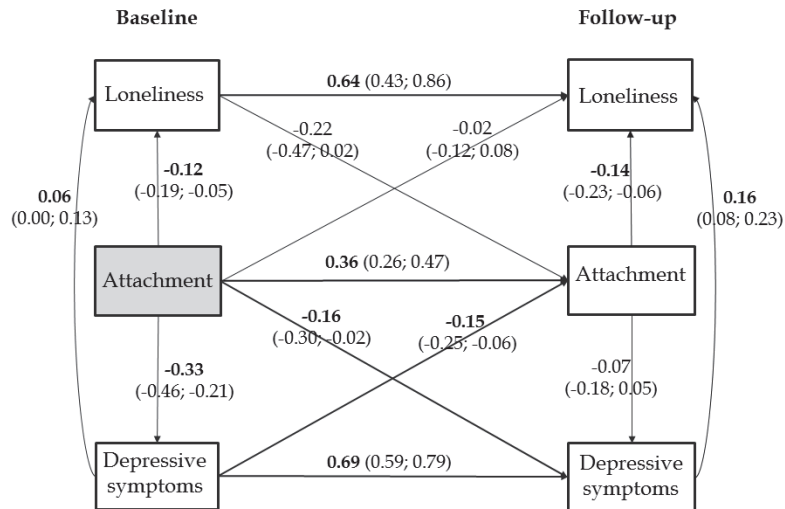


FIGURE 8 Unstandardized coefficients (95 % confidence intervals) of cross-lagged model for perceived attachment, depressive symptoms, and loneliness during the six-month follow-up (n=222).

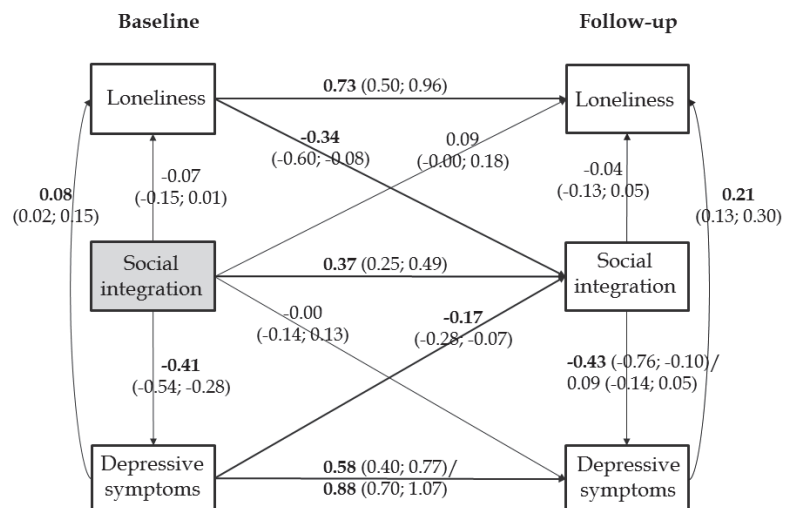


FIGURE 9 Unstandardized coefficients (95 % confidence intervals) of cross-lagged model for perceived social integration, depressive symptoms, and loneliness during the six-month follow-up. For unequal group effects, the upper value is the estimate of the social intervention group effect and the lower value is the estimate of the self-directed control group effect.

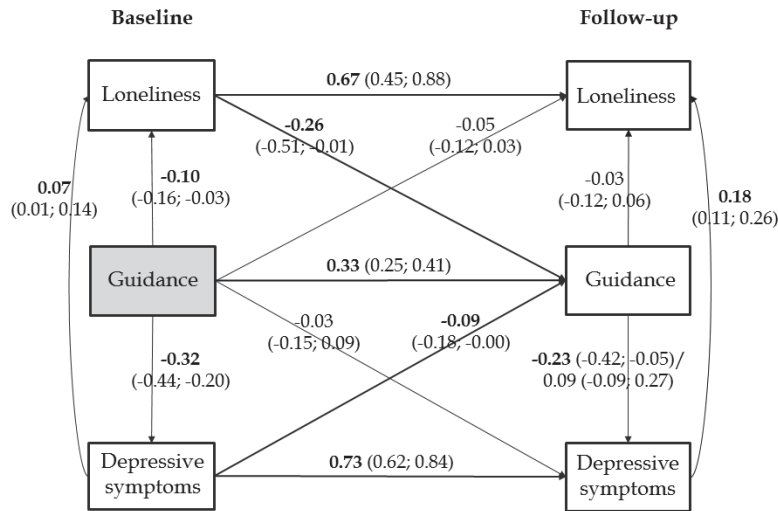


FIGURE 10 Unstandardized coefficients (95 % confidence intervals) of cross-lagged model for perceived guidance, depressive symptoms, and loneliness during the six-month follow-up.

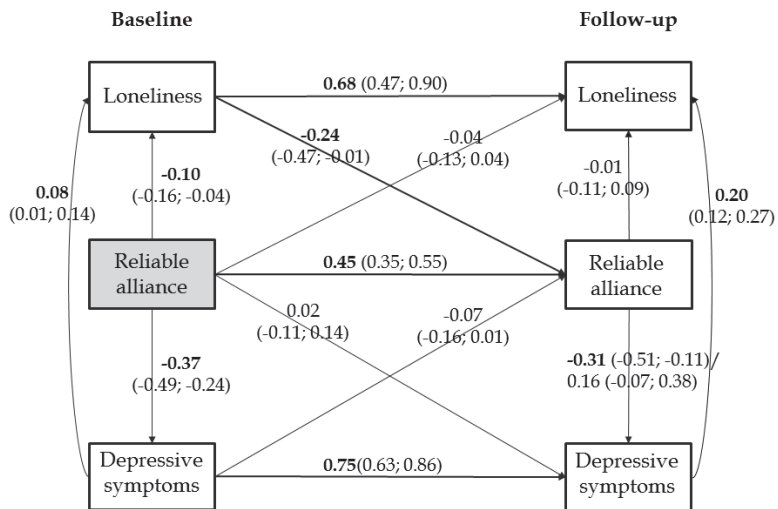


FIGURE 11 Unstandardized coefficients (95 % confidence intervals) of cross-lagged model for perceived reliable alliance, depressive symptoms, and loneliness during the six-month follow-up. For unequal group effects, the upper value is the estimate of the social intervention group effect and the lower value is the estimate of the self-directed control group effect.

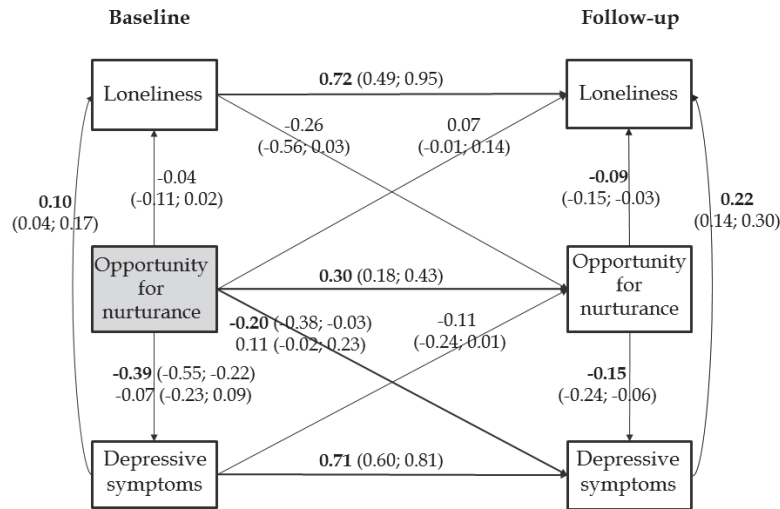


FIGURE 12 Unstandardized coefficients (95 % confidence intervals) of cross-lagged model for perceived opportunity for nurturance, depressive symptoms, and loneliness during the six-month follow-up.

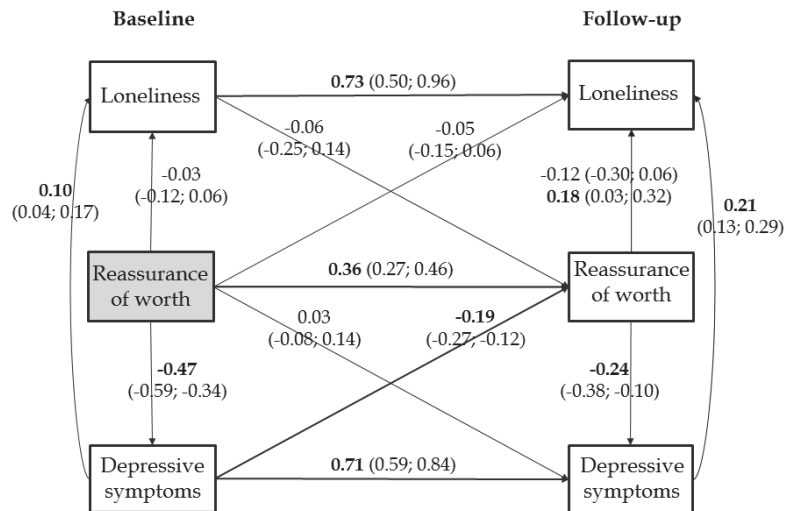


FIGURE 13 Unstandardized coefficients (95 % confidence intervals) of cross-lagged model for perceived reassurance of worth, depressive symptoms, and loneliness during the six-month follow-up. For unequal group effects, the upper value is the estimate of the social intervention group effect and the lower value is the estimate of the self-directed control group effect.

5.6 Effect of a social intervention on feelings of loneliness, melancholy, depressive symptoms, and the dimensions of perceived togetherness (Study IV)

The six-month intervention did not affect depressive symptoms. The number of symptoms remained at the same level over the six-month intervention (Table 9, Figure 14). Feelings of loneliness and melancholy decreased in both the intervention and control groups. The improvement in melancholy (Figure 15) and loneliness (Figure 16) remained up to the 12-month post-intervention follow-up. Of the dimensions of perceived togetherness, guidance and attachment increased in both groups during the six-month intervention. The time and group-by-time interaction effects were statistically significant for social integration, indicating positive change only in the intervention group.

TABLE 9 Means, standard deviations (sd), and generalized estimating equations (GEE) model parameters for time-, group-, and group-by-time interaction for depressive symptoms, melancholy, loneliness, and the dimensions of perceived togetherness in the intervention (n=105) and control (n=118) groups at baseline and after the 6-month intervention.

	Baseline		After the intervention		<i>p</i> -value for type III GEE model effect		
	Interven- tion group	Control group	Interven- tion group	Control group			
	Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)	Time	Group	Group x time
Depressive symptoms	3.91 (2.71)	3.47 (2.33)	3.73 (2.86)	3.32 (2.61)	0.204	0.191	0.885
Social integration	12.30 (2.17)	12.75 (2.15)	12.92 (2.00)	12.77 (2.18)	0.027	0.553	0.041
Reliable alliance	12.90 (2.36)	13.23 (2.09)	13.04 (2.35)	13.54 (1.77)	0.103	0.098	0.542
Guidance	12.56 (2.64)	13.08 (2.31)	13.22 (2.35)	13.54 (1.90)	0.001	0.106	0.550
Attachment	12.06 (2.73)	12.48 (2.10)	12.70 (2.44)	12.93 (2.10)	0.001	0.233	0.534
Nurturance	11.60 (2.74)	12.07 (2.34)	11.71 (3.00)	12.11 (2.28)	0.678	0.143	0.849
Reassurance of worth	11.61 (2.01)	11.86 (2.04)	11.65 (1.91)	12.17 (1.80)	0.174	0.088	0.286
	%	%	%	%			
Melancholy					0.001	0.190	0.789
-no/rarely	17.1	18.6	26.7	33.9			
-sometimes	69.5	72.9	63.8	59.3			
-often	13.3	8.5	9.5	6.8			
Loneliness					<0.001	0.487	0.578
-no/rarely	33.3	30.5	53.3	48.3			
-sometimes	52.4	55.9	36.2	39.0			
-often	14.3	13.6	10.5	12.7			

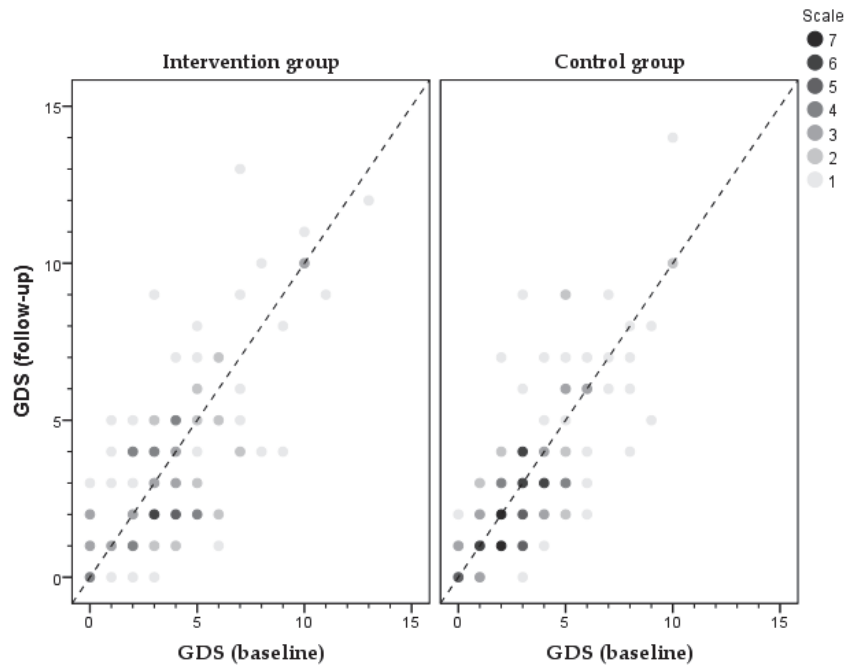


FIGURE 14 Scatterplot of depressive symptoms with identity line (dashes) at baseline and six-month follow-up.

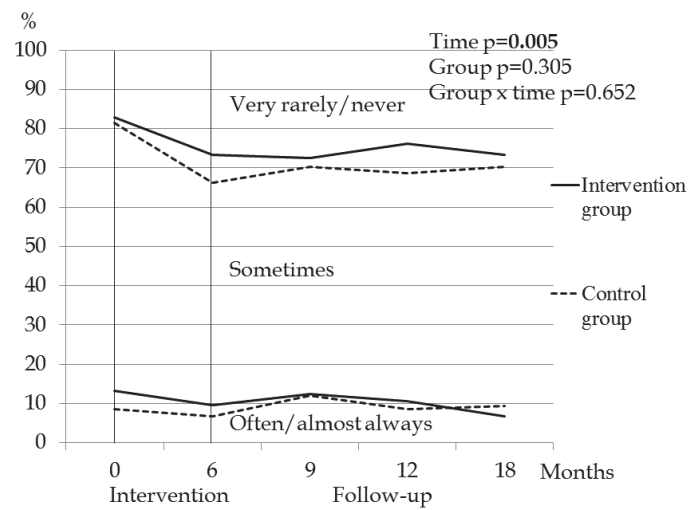


FIGURE 15 Proportions of participants reporting feelings of *melancholy* at baseline, after the 6-month intervention, and at the 3, 6, and 12-month post-intervention follow-ups, and generalized estimating equations (GEE) model parameters for time-, group-, and group-by-time interaction for the whole follow-up period.

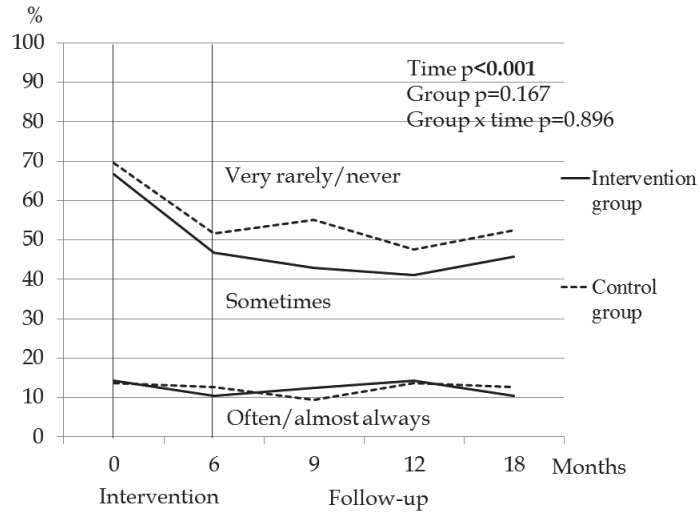


FIGURE 16 Proportions of participants reporting feelings of *loneliness* at baseline, after the 6-month intervention, and at the 3, 6, and 12-month post-intervention follow-ups, and generalized estimating equations (GEE) model parameters for time-, group-, and group-by-time interaction for the whole follow-up period.

Ancillary analyses conducted for the intervention regimes did not add to the existing results. In each regime, social integration, attachment, and guidance increased, and feelings of loneliness and melancholy decreased during the six-month intervention. Ancillary analyses among those who were categorized as depressed (GDS score ≥ 5 ; $n=36$ in the intervention and 34 in the control group) or non-depressed (GDS score 1–4; $n=69$ in the intervention and 84 in the control group) revealed no additional information on the effectiveness of the intervention. Overall, while the time effects indicated that depressive symptoms decreased among those who were depressed and loneliness decreased among those who were non-depressed, the changes were similar in the intervention and the control groups. As a consequence of the intervention, social integration increased only among those who were non-depressed at baseline.

6 DISCUSSION

The aim of this research was to investigate, first, the associations and, second, the causality between social activity or perceived togetherness and health in old age. A further purpose was to investigate potential mediators in these associations among older people. Those who were more active in collective social activity had a lower risk for mortality and their mobility explained part of this association. Better cognitive functioning and fewer depressive symptoms were prerequisites for participating in social activities. The cross-lagged analyses suggested that deficits in perceived togetherness did not lead to loneliness and not systematically to depressive symptoms, either. Instead, it appeared that loneliness and, especially, depressive symptoms preceded deficiencies in perceived togetherness. A social intervention did not decrease loneliness, melancholy, or depressive symptoms, suggesting that increased collective social activity did not affect these mental phenomena. However, over time, loneliness and melancholy were alleviated, also equally among controls, suggesting no additional benefit from the social intervention.

The conceptual model of Berkman and colleagues (2000) was useful in parsing and inserting the social variables of my research in the model template. When participating in social activities persons get together and spend time and do things with each other. Collective social activity increased sense of social integration. Parallel with the model, I investigated mobility, cognitive functioning, and depressive symptoms as potential mediators between the association of social activities and mortality risk. However, the present results were only partially in line with the model. Following the model, collective social activity was associated with mortality risk and that mobility partially mediated the association between social activities and mortality risk. The analyses otherwise showed that while a higher level of social activities, greater contentment in the dimensions of perceived togetherness, fewer feeling of loneliness and fewer depressive symptoms often co-existed, the direction or temporal order of the associations was not in line with the model. In addition, the strongest causal evidence attributable to the randomized controlled trial suggests that increased social activity may not alleviate depressiveness or loneliness. One aspect reduc-

ing the usability of the model is that the model does not address how to control for the covariates that may underlie the associations between social aspects of life and health in old age. For instance, in this study, age, chronic conditions, cognitive functioning, difficulties in mobility, and physical activity were associated with mortality risk in addition to collective social activity while age, marital status, and cognitive functioning were associated with institutionalization. Because these factors are also related to social activity, it is important to they be carefully considered to avoid positive confounding.

The results of the present observational analyses showed that those who were more active in collective social activity had a reduced risk for mortality. Other studies, which have used comparable measurements of collective social activities, have reported similar results to those of the present study (Glass et al. 1999). Better mobility partially explained the association between collective and productive social activities and mortality risk. Earlier studies have reported that more frequent participation in social activities decreases the risk for developing need for help in mobility tasks among older persons (Mendes de Leon, Glass & Berkman 2003; Avlund et al. 2004; James et al. 2011). These results combined with those presented here lead me to conclude that collective and productive social activity may slow down health decline in older people. Social interaction may encourage a more active lifestyle, thereby helping to maintain better mobility and functioning and thus correlate with reduced mortality risk. It is also worth noting that physical activity is a component of most of the social activities that take place outside the home. Going to destinations outside the home increases walking even when people use a vehicle for transportation (Portegijs et al. 2015).

I found that better cognitive functioning and fewer depressive symptoms were prerequisites for social activities rather than mediators between social activity and mortality risk. Thus, it can be concluded that health resources, especially having fewer depressive symptoms and better cognitive functioning, enables older people to participate in social activities which, in turn, help to maintain better health and decrease the risk for mortality and institutionalization. This is against the general belief of the active ageing paradigm. According to the "use it or lose it" hypothesis of cognitive ageing, social activity offers protective benefits from age-related cognitive decline (Bielak 2010). It is also suggested that there is a cyclical directionality which means that high levels of intellectual functioning lead to high levels of complex leisure activity, which in turn raise or maintain level of intellectual functioning with age (Schooler & Mulatu 2001). Thus, it may also be possible that participation in various hobbies may include cognitive stimulation and help to maintain better health, although our data did not support this perspective. Some other previous studies have also found that better cognitive functioning and fewer depressive symptoms enables older persons to participate more actively in social activities (Aartsen et al. 2002; Agahi, Ahacic & Parker 2006; Wilkie et al. 2016). It is possible that withdrawing from social activities taking place outside the home may be among the first signs of worsening cognitive functioning. It is also possible that

cognitive decline makes transportation more difficult. In Finland, to continue driving a car after age 70, a physician's assessment of person's competency to drive a car is required. If cognitive disorder is apparent, the person's driving license may be revoked. Cognitive decline may also increase the risk of getting lost in areas further away from home, which in turn, predisposes people to avoiding venturing very far from home. Thus, activity reduction is the consequence of cognitive decline. People with depressive symptoms may lack the initiative to participate in social activities outside the home. They may need extra support, including company, to motivate their participating.

In his theory of social provisions, Weiss (1973, 17) proposed that "loneliness appears always to be a response to the absence of some particular relational provision". Based on the theory, I expected the dimensions of perceived togetherness to precede feelings of loneliness. Several earlier cross-sectional studies have provided indirect evidence for the theory by observing that deficits in the dimensions of perceived togetherness are more prevalent among people who report loneliness than among those who do not (Tiikkainen & Heikkinen 2005; Drageset, Espehaug & Kirkevold 2012). The results of the present longitudinal analyses did not support this view, as no cross-lagged associations were observed between the dimensions of perceived togetherness at baseline and loneliness at follow-up. However, sense of attachment, guidance, reliable alliance, and opportunity for nurturance were associated cross-sectionally with loneliness either at baseline or at follow-up. In addition, lower feelings of loneliness at baseline predicted higher perceived social integration, guidance, and reliable alliance at follow-up. Thus, the results of this study, and those received by other researchers, suggest that lower scores in the dimensions of perceived togetherness might describe features or be indicators of loneliness rather than be antecedents of feelings of loneliness. However, I still think that when a sense of loneliness express sense of deprivation in social interaction the dimensions of perceived togetherness illustrate a positive angle on social relationships as well.

It is possible that in different life situations and phases different dimensions of perceived togetherness become more central to mental wellbeing. My results suggest that sense of attachment and opportunity for nurturance are important dimensions of perceived togetherness in relation to depressive symptoms also in older people. Weiss (1973, 18) suggested that emotional loneliness emerges in the absence of a close reliable emotional attachment. In this study, a lower sense of attachment both at baseline and follow-up coexisted with loneliness and predicted depressive symptoms at follow-up. Loneliness, measured by a single question, has been found to correlate, specifically, with emotional loneliness (Van Baarsen et al. 2001). Attachment stems from a sense of safety, security, and being loved which are most often experienced in relationships with one's spouse or close friends (Weiss 1974). Deficit in attachment may underlie earlier findings that people living alone (Routasalo et al. 2006), not married (Van Baarsen et al. 2001; Jakobsson & Hallberg 2005) or reporting lack of friends (Savikko et al. 2005) experience loneliness more often than others. Hawkey and her colleagues (2008) found that being married was negatively associated with

loneliness if the marital partner was experienced as a confidant. It is possible that experiencing attachment in one's social relationships provides a feeling of being liked, trusted, accepted, understood, and mattering to others, thereby reducing the risk for depression (Taylor & Turner 2001).

Importance of having opportunities for nurturance and experiencing reassurance of worth in one's social relationships for mental well-being describes the aspect that people, also in old age, need possibilities to help and be responsible for the well-being of other persons, or to generate common well-being. Transcending him- or herself toward another human being or common good, something other than themselves, enables a person to find and fulfill meaning in his or her life (Frankl 1988, 48, 60). According to Frankl (1984, 121), man's search for meaning is a primary motivation in his life. Sense of meaning refers to believing that one's actions have a place in the order of things and that one's behavior fits appropriately into a larger social whole (Krause 2009). A person may also feel that he or she is a vital member of society (Keyes 1998). Older people who have found a sense of meaning in life are more likely to experience fewer depressive symptoms than individuals who have not been able to derive a sense that their lives have meaning (Boman et al. 2015; Van der Heyden, De-zutter & Beyers 2015). Greater feelings of usefulness (Gruenewald et al. 2007; Gruenewald et al. 2009) and greater meaning (Krause 2009) have also been found to be associated with decreased mortality risk. The effect of a meaning on mortality may operate through the maintenance of better health (Krause 2009).

Based on the results of observational (Isaac et al. 2009) and intervention studies (Cattan et al. 2005; Dickens et al. 2011), I expected that a social intervention could help reduce loneliness and depressive symptoms among people who reported either of these. The results of the randomized controlled trial, however, indicated that increased collective social activity did not help in alleviating depressive symptoms or loneliness. The results add to the diversity of previous findings on the effectiveness of interventions in reducing depressiveness or loneliness in older people. Some randomized controlled trials have reported a decrease in depressive symptoms (Constantino 1988; Timonen et al. 2002; Bohlmeijer, Smit & Cuijpers 2003; Pinguart, Duberstein & Lyness 2007) or loneliness (Anderson 1985; Ollonqvist et al. 2008). Other targeted interventions, however, have not been successful in alleviating depressive mood (Arnetz, Theorell & Arnetz 1983; White et al. 2002) or loneliness (White et al. 2002; Routasalo et al. 2009). The design of the intervention used in this study was based on interventions that had shown positive results in previous studies; however, no benefits with respect to loneliness, melancholy, and depressive symptoms, beyond those achieved naturally over time, were detected. Some other studies have similarly reported, e.g., attenuation of feelings of loneliness in the control group during the study period (see e.g. Kremers et al. 2006; Martina & Stevens 2006).

A more individualized therapeutic perspective might have resulted in an improvement in depressiveness (see Pinguart, Duberstein & Lyness 2007) and loneliness, especially among those experiencing loneliness or melancholy al-

most always or continuously. Loneliness may be difficult to alleviate as it has various biological, psychological, and social predispositions (Luanaigh & Lawlor 2008). Theories of loneliness emphasize the role of factors relating to personality or traits, or various states in a person's life. Loneliness may be associated with loss of a confidant and the resultant grief, lack of meaningful social relationships, dissatisfaction with existing relationships, existential questions, deficits in early attachment relationships, or shyness and fears in social situations. Thus, in seeking to reduce loneliness, we should consider existing social relationships, characteristics of those relationships, deficits in social needs and perceived social support as well as possible difficulties in social relationships and interaction. Individuals' personal goals and personality factors direct their social engagement. For example, gregariousness or extroversion facilitates friendships (Johnson & Troll 1994). In the GoodMood study, the possibility to choose between joining the exercise or social activity group or personal counselling may have contributed to positive change in participants' sense of social integration. On the other hand, some of the participants may have chosen an intervention regime that was less suitable for them, and which may therefore have led to no change or even negative changes in loneliness, melancholy, or depressive symptoms. It would be essential to identify both the factors that are related to an individual's feelings of loneliness and depressive mood and the factors that may help him or her to promote his or her well-being.

The results of the present study emphasize the importance of taking into account depressive symptoms and loneliness of an older person as they predicted a lower sense of attachment, social integration, guidance, reliable alliance, and reassurance of worth at six-month follow-up. This is in line with the results of a study on the predictors of social support in older people by Cutrona and colleagues (1986). A depressed person or somebody suffering from loneliness may not have the energy for social contacts. In addition, feelings of loneliness and depressive mood may evoke negative thoughts and thus impair perceptions of togetherness. Negative emotional states may narrow a person's outlook on life (Fredrickson 2009, 23) while positive emotions broaden thought-action repertoires and expand awareness, allowing people to take in more contextual information, at least temporarily (Fredrickson 2001; Fredrickson 2013).

In the present randomized controlled trial, comparable positive changes were observed in the social intervention and control groups in depressive symptoms among those depressed at baseline, and in feelings of melancholy, loneliness, attachment, and guidance across the whole study group. The proportion of those reporting loneliness decreased and the proportion of those never or rarely feeling loneliness increased during the intervention period. All the participants met with a counsellor once before randomization. It is possible that just having the one discussion helped people to move on in life by somewhat alleviating their feelings of loneliness and negative mood. Hobbies outside the home increased in both the intervention and control groups. For some older people, reflective and solution-focused counselling may lead them to start solving their problems and initiate positive behaviours that help to mitigate

feelings of loneliness and depressive mood. However, this does not rule out the fact that some older people need more efficacious interventions, such as for addressing maladaptive social cognition (Masi et al. 2011).

Despite the general observation that the positive changes in the intervention and control groups were comparable, some positive changes were attributable to the intervention. Perceived social integration improved as a consequence of the intervention, and the improvement was parallel in size in each of the three intervention regimes. Social integration refers to experiencing oneself as part of group or having people around one who enjoy the same social activities, think the same way about things, have the same interests and concerns, and like to do things in the same way as oneself. Lack of social integration is associated with social loneliness and might best be resolved by acquiring new contacts. In a pilot study focusing on older people who were clients of home health care, receiving volunteer visitors over a period of six weeks improved older persons' perceived social integration (MacIntyre et al. 1999). Meeting peers in a group setting or a counsellor in a one-to-one setting may offer the older person positive stimulation along with emotional support and attention (see the multidimensional model of affiliation in Hill 1987; Hill 2009) which, in turn, may enhance the experience of acceptance and belonging (see Leary & Kelly 2009). In addition, in the intervention group, higher level of opportunity for nurturance, social integration, guidance, and reliable alliance were associated with fewer depressive symptoms. Joining a group may decrease preferences for staying at home, perceptions of having lost valued activities, feelings that life is empty, or perceiving other people are better off than oneself, all of which are items rated in the Geriatric Depression Scale (Greenberg, 2007).

6.1 Methodological considerations

The data in the Evergreen study consisted of a representative population-based sample of older people living in the community with follow-up periods for institutionalization up to 16 years and mortality up to 21 years. Using the population register database for recruiting participants ensured that individuals with diverse socioeconomic backgrounds and health status were included in the study. However, it should be noted that more people with poor health status were among the non-respondents and those who were excluded from the analyses because they died soon after the baseline assessments than those included in the analyses. Overall, the response rate was high (80 %), the proportion of those excluded small (3.5 %), and the data on deaths and long-term care decisions were reliable with complete coverage. Thus, I consider that the results can be generalized to community-dwelling older people. The results concerning institutionalization may, however, be more contextually bound, since the criteria for institutionalization change over time and models of organizing and financing care differ between countries.

The strengths of the GoodMood study were the study design and the sampling and screening methods used. The target population included all the residents in a defined age group living in a specific geographical area. Those recruited, based on their feelings of loneliness, melancholy, or depressed mood, were otherwise comparable with those who did not meet the study inclusion criteria. Compared to studies based on non-probability or convenience samples, the present recruitment procedure is likely to yield a less selected group of participants. Consequently, the study provides us with an idea of the effectiveness of social interventions in a “real life” environment. Those who dropped out during the study did not differ in their feelings of melancholy from those who continued to participate. The possibility for participants to choose the intervention regime they preferred may have reduced the drop-out rate. Follow-ups via telephone up to 12 months post-intervention enabled observation of the status of loneliness and negative mood after the intervention among the study participants. The design and implementation of the study could also be applied in other populations of older people.

In the third study, exploratory observational analysis based on the GoodMood randomized controlled trial data was conducted to investigate the possible associations between the dimensions of perceived togetherness, loneliness, and depressive symptoms during the six-month time frame. However, since the groups randomized for the study were alike in most of the variables of interest and the initial two-group design was taken into account in the analyses, I do not consider that this materially biased the results. The study included a larger proportion of people reporting feelings of loneliness and depressive symptoms and fewer people with high emotional wellbeing compared to the general population of corresponding age. In this sense, the distributions of loneliness and depressive symptoms were truncated. However, selecting the sample with characteristics that we wished to study should not be seen as a weakness, as it captures a high enough prevalence to enable multivariate analyses in the target population in a randomized trial setting. Moreover, the results can be generalized to the older population feeling loneliness or depressive mood at least occasionally.

One weakness of the GoodMood randomized controlled trial was that determination of the sample size was not based on an a priori power analysis. However, power calculation conducted after data collection, without looking at the data, suggested that for a follow-up correlation of 0.75, a 15 % difference in mean depressive symptoms between intervention and control groups would be significant at the 0.05 level of significance. Thus, it is reasonable to conclude that, for depressive symptoms, the results of the randomized controlled trial were based on the real-life situation and not on the low number of participants. Another weakness of the randomized controlled trial was that the use of medications for psychic disorders was not controlled for in the analyses. Thus, the possibility cannot be excluded that the improvement in loneliness and melancholy in the control group might have been a consequence of starting to use medication for psychic disorders. However, it is unlikely that so many partici-

pants would have started using medication for psychic disorders during the intervention as to have affected the results of the study.

Dividing social activity into collective and productive social activities was based on theoretical considerations and validation was done by using exploratory and confirmatory factor analyses. The collective social activity factor comprised leisure activities that are usually conducted with other people and participation in which may require certain health resources. The productive social activity factor described activity in helping other people in different instrumental tasks. However, the distinction between the two forms of social activity is theoretically problematic as these categories are not clearly separable.

A potential important limitation is that other meaningful social activities may not have been captured in the interviews, such as informal social gatherings and volunteering. Low participation rates in the variables of helping other people may be a primary reason for the non-significant finding for productive social activity. Furthermore, giving help to other people captures only part of productive social activity. In the data on participation in collective social activities, it was not possible to differentiate whether the person who responded 'yes' did the activity alone or in a group. However, going to cultural events, singing, practicing visual art, or studying is for many older persons likely to be carried out in a social context. Inclusion of these activities in the variable describing collective social activity may have caused some measurement error, but leaving them out would have led to underestimation of participation in these activities. One characteristic of long follow-up studies is that study items are measured based on the best knowledge available at the baseline moment. Thus, the items in this study may not all have been consistent with present knowledge on the topic.

Using a proportional hazard regression model for mortality risk (Cox 1972) enabled accounting for time to mortality. Competing risks models (Fine & Gray 1999) were used to analyse time to institutionalization, which is an extension of the proportional hazards model, and which enable focus on the sub-distribution of risk for institutionalization and treating mortality risk as an adjusting outcome. Had the model not been adjusted for mortality risk, this might have led to underestimation of associations between social activities and risk for institutionalization. As by follow-up end 22 % of the participants were institutionalized and 51 % had died without first being institutionalized, it was important to use mortality as a competing outcome. In addition, in long follow-up times, different intervening variables may confound the possible association between the variables of interest and the outcome.

In the second study, in which mobility, cognitive functioning, and depressive symptoms were investigated as potential mediators in the association between social activity and mortality risk, using a cross-sectional study frame for the explanatory variables is a potential limitation. However, I studied both mediation and competing models, and determined which models showed best fit to the data.

Cross-lagged models allow baseline measurements and their stability to be incorporated into the analyses. Longitudinal cross-lagged associations describe existing associations between variables and provide evidence indicative of causality. The use of cross-lagged modelling enabled several variables to be included in the analyses at the same time and inspection possible simultaneous links between the variables. Analysing the different dimensions of perceived togetherness in separate models made it possible to detect differences in the associations of these dimensions with loneliness and depressive symptoms.

The randomized controlled trial enabled study of the potential causal relationships between increased social activity and depressive symptoms, melancholy, loneliness, and the dimensions of perceived togetherness. Having a control group in the study permitted the conclusion that the positive changes observed over time were not specific to the intervention group. In the absence of a control group, I would likely have erroneously interpreted the results to mean that the intervention alleviated the problems of interest.

This dissertation research foregrounds just how different results of observational studies and randomized controlled trial can be. Randomized controlled trials give the strongest evidence of causal associations between variables. Ideally, randomization eliminates the effect of random variables on the association of interest, and the result can be concluded to be effect of the intervention. On the other hand, it should be remembered that some health-enhancing characteristics in social relationships may require a long period in which to develop, and thus it may be difficult to achieve improvements in health outcomes through relatively short interventions. However, observational studies are also needed, as hypotheses in randomized controlled trials are usually based on the results of observational studies.

In sum, the results of this research add to the earlier literature on the association between social engagement and health decline. Theorizing and dividing social activity to collective and productive social activity gave a new perspective compared to earlier studies. However, the issue of productive social activity and its potential health effects needs further research. This research also extends the earlier knowledge by providing evidence that better cognitive functioning and low number of depressive symptoms may be prerequisites for more active participation in social activities. On the associations between the dimensions of perceived togetherness, feelings of loneliness, and depressive symptoms, this research contributes to the literature by providing evidence based on longitudinal analyses that allowed stability in loneliness and depressive symptoms to be taken into account. The results contradicted the theory of social provisions by Weiss in suggesting that loneliness and depressive symptoms may be antecedents of experiencing perceived togetherness rather than vice versa. Finally, the results of this research add to the diversity of previous findings on the relative effectiveness of interventions aiming to reduce depressiveness or loneliness in older people. In addition to gaining deeper understanding why and how social engagement relates to health, this study also informs social and health care professionals, policy makers, and people responsible for the devel-

oping of interventions of the aspects relating to social engagement which should be taking into account when aiming to promote health and well-being of older people.

6.2 Future directions

More studies are needed on the effects of social interventions on loneliness and depressive mood among older people. The present results lay foundation for further research using mini-interventions. In the GoodMood study all the participants met a counsellor once before the randomization, which may have resulted in the improvements observed in the control group. It may be worth studying if a mini-intervention with one to two reflective and solution-focused discussions taking into account person's own life goals might help older people to initiate positive self-directed actions toward achieving better health and mental well-being. There is also need for measuring mental well-being in broader ways than just as the mere absence of depressive mood.

Another question for future studies is how persons with severe and constant feelings of loneliness or depressed mood may be helped. As the results of this research suggest that low scores on depressive symptoms and loneliness may be prerequisites for participating in social activities, social activities may not be a feasible way to help them.

More longitudinal research is needed on the direction of the association between cognitive functioning, depressive symptoms, and social activity in order to achieve a deeper understanding of this association. Beside cognitive functioning and depressive symptoms, other factors such as personality trait, person's goals, self-identity, and coping strategies may be important to take into account when studying explanative factors of participating in collective and productive social activities or effect of social activities of maintaining lower level of depressive symptoms. In addition, we need more longitudinal studies on the associations between the dimensions of perceived togetherness and different dimensions of mental well-being among older people to define which comes first. Such knowledge helps to gain deeper understanding of the phenomenon as well as to lay the foundation for planning interventions to alleviate loneliness and increase mental well-being among older people.

Questionnaires used in this dissertation did not include questions on participation in organized volunteering or giving other kind of social support than helping in tangible everyday chores. Thus, studies on associations between productive social activity and various descriptors of health should involve both informal and formal as well as tangible, informational, appraisal, and emotional support given in their questionnaires. I am interested in the question of whether productive social activity is positively related to sense of opportunity for nurturance and reassurance of worth and experiencing oneself as a valuable member of society. In addition, we should find new ways to promote productive social activity, as this draws on the knowledge and skills accumulated during

the life-course. It is under question whether social engagement, experiencing attachment, and feeling needed give an older person meaning in life, and whether meaning in life help to maintain mental well-being in old age.

7 MAIN FINDINGS AND CONCLUSIONS

The main findings and conclusions can be summarized as follows:

1. Persons who were more active in collective social activity had a reduced risk for mortality and initially for institutionalization.
2. Better mobility explained part of the association between social activities and mortality risk. Better cognitive functioning and fewer depressive symptoms were prerequisites for participating in social activities.
3. Deficits in perceived togetherness did not lead to loneliness. Instead, loneliness and depressive symptoms preceded deficiencies in perceived togetherness. However, a higher sense of attachment and opportunity for nurturance predicted fewer depressive symptoms.
4. The social intervention did not decrease loneliness, melancholy, or depressive symptoms, suggesting that increased collective social activity did not affect these mental phenomena. However, loneliness and melancholy were alleviated over time, also equally among controls, suggesting no benefit specifically from the social intervention. Some positive changes were observed in perceived social integration as a direct consequence of the intervention.

Collective and productive social activity may contribute to preventing health decline in older people, although decent health resources are required to be socially active. Higher level of social activities, contentment in perceived togetherness, less feeling of loneliness and depressive symptoms often co-exist, but increased social activity may not lead to improvements in these variables.

YHTEENVETO (FINNISH SUMMARY)

Sosiaalinen osallistuminen, koettu yhteisyys, mieliala ja kuolleisuus ikään- tyneenä

Sosiaaliset suhteet, sosiaalinen aktiivisuus, myönteinen vuorovaikutus toisten ihmisten kanssa ja sosiaalisten tarpeiden täyttymisen kokemus myötävaikuttavat ikäihmisten hyvinvointiin. Tämän väitöskirjatutkimuksen tavoitteena oli tarkastella sosiaalisen aktiivisuuden ja koetun yhteisyyden eri ulottuvuuksien ja terveyden heikkenemisen välistä yhteyttä. Lisäksi tavoitteena oli tarkastella tätä yhteyttä välittäviä tekijöitä.

Sosiaalista osallistumista tarkasteltiin tässä tutkimuksessa kollektiivisena ja produktiivisena sosiaalisena aktiivisuutena (Bukov, Maas & Lampert 2002). Kollektiivinen sosiaalinen aktiivisuus viittaa sosiaalisessa kontekstissa tapahtuvaan toimintaan, jossa ihmiset jakavat aikaansa toistensa kanssa ja tekevät asioita yhdessä. Kulttuuriharrastukset, tanssi, opiskelu, matkustaminen, järjestötoimintaan, liikuntaryhmiin ja seurakunnan toimintaan osallistuminen ovat esimerkkejä kollektiivisesta sosiaalisesta aktiivisuudesta. Produktiivinen sosiaalinen aktiivisuus puolestaan viittaa toimintaan, jossa ihminen käyttää aikaansa ja osaamistaan toisten hyödyksi tai yhteiseksi hyväksi. Tässä tutkimuksessa produktiivista sosiaalista aktiivisuutta tarkasteltiin sukulaisten, ystävien ja naapureiden auttamisena erilaisissa arjen toimintoihin liittyvissä asioissa kuten siivoamisessa, kaupassa käymisessä ja ulkoilussa. Lisäksi vapaaehtoistyön voidaan katsoa sisältävän produktiiviseen sosiaaliseen aktiivisuuteen.

Koettu yhteisyys viittaa sosiaalisten suhteiden kokemiseen sekä sosiaaliseen tukeen, jota ihmiset antavat ja vastaanottavat toinen toisiltaan (Tiikkainen, Heikkinen & Leskinen 2004). Weiss (1974) on teoriassaan määritellyt sosiaalisten suhteiden vastaavan kiintymyksen, liittymisen, neuvojen saamisen, luotettavan henkilön olemassaolon, hoivan antamisen mahdollisuuden ja osaamisen ja kykyjen arvostamisen tarpeisiin. Edellä mainittuja sosiaalisia tarpeita on tässä tutkimuksessa tarkasteltu koetun yhteisyyden eri ulottuvuuksina. Vaikka yksin asumisen, sosiaalisten kontaktien ja ryhmiin osallistumisen vähäisyyden on ikäihmisillä todettu olevan yhteydessä yksinäisyyden kokemiseen, suhteiden laadulliset piirteet ovat keskeisempiä yksinäisyyteen liittyviä tekijöitä. Weissin (1973, 17) mukaan se, että yksilön ihmissuhteet eivät vastaa hänen sosiaalisiin tarpeisiinsa ja mahdollista yhteisyyden kokemuksia, johtaa yksinäisyyteen ja depressiivisyyteen. Noin 5 % suomalaisista ikäihmisistä raportoi kokevansa yksinäisyyttä usein tai lähes aina (Savikko et al. 2005; Tiikkainen & Heikkinen 2005) ja 39 % vähintään silloin tällöin (Routasalo et al. 2006).

Mielenterveys koostuu emotionaalisesta, psykologisesta ja sosiaalisesta hyvinvoinnista sekä masennusoireiden vähäisyydestä (Kokko et al. 2013). Suomalaisista 75-vuotiaista kotona asuvista naisista kolmasosa ja saman ikäisistä miehistä neljäsosa raportoi kokevansa masennusoireita. Masennusoireiden ilmaantuminen lisääntyi ikävuosien 80 ja 85 välillä erityisesti naisilla (Heikkinen & Kauppinen 2004). Masennusoireet ovat yhteydessä mm. sosiaalisessa vuoro-

vaikutuksessa ilmeneviin vaikeuksiin ja osallistumisen vähäisyyteen, yksinäisyyteen ja erilaisiin terveysongelmiin. Masennusoireet voivat olla osa ikäihmisen sopeutumisprosessia elämässä eteen tuleviin muutoksiin, mutta pitkittyyssään ne voivat edelleen johtaa fyysisen ja psyykkisen terveyden heikkenemiseen.

Kuolleisuuden ja pitkäaikaiseen laitoshoitoon sijoittumisen riski kuvaa tässä tutkimuksessa terveyden heikkenemistä. Kuolleisuustutkimuksessa voidaan tarkastella välittömiä kuolinsyitä tai kuolleisuutta ennustavien tekijöitä, jotka vaikuttavat vuosikymmenien kuluessa. Sosiaalisen aktiivisuuden on aiemmissa tutkimuksissa todettu ennustavan pienempää kuolleisuuden riskiä. Pitkäaikaiseen laitoshoitoon sijoittumista määrittävät terveyden heikkenemisen lisäksi muuttuvat hoidon kriteerit, maiden väliset erot sosiaali- ja terveystalouden järjestämisessä sekä iäkkään henkilön sosiaalisen verkoston mahdollisuudet vastata hänen avun tarpeisiinsa.

Tämän väitöskirjatutkimuksen aineistoina käytettiin kahden laajemman tutkimusprojektin aineistoja. 1) Ikivihreät-projekti on monitieteinen seuranta-tutkimus iäkkäiden jyvaskyläläisten terveydestä ja toimintakyvystä. Tässä väitöstutkimuksessa käytettiin 65–74-vuotiaiden haastatteluaineistoa (n=1 181). Tiedot pitkäaikaiseen laitoshoitoon siirtymisestä ja kuolleisuudesta kerättiin paikallisista ja kansallisista rekistereistä. 2) HyväMieli-hanke oli 1,5 vuotta kestänyt kokeellinen tutkimus, jossa kohdejoukko koostui 75–79-vuotiaista yksinäisyyttä tai alakuloa vähintään silloin tällöin kokevista jyvaskyläläisistä (n=222–223). Interventoryhmäläiset osallistuivat kuuden kuukauden ajan liikuntaryhmään, sosiaaliseen virikeryhmään tai henkilökohtaiseen neuvontaan. Molemmassa tutkimushankkeissa tiedot sosiaalisista ja terveyteen liittyvistä tekijöistä kerättiin osallistujien kotona toteutetuilla haastatteluilla.

Tulokset osoittivat, että niillä henkilöillä, jotka olivat aktiivisempia kollektiivisiin sosiaalisiin toimintoihin osallistumisessa, oli pienempi kuolleisuuden ja pitkäaikaiseen laitoshoitoon sijoittumisen riski noin 17 vuoden seurannan aikana verrattuna vähemmän aktiivisiin henkilöihin. Osa kollektiivisen ja produktiivisen sosiaalisen aktiivisuuden ja kuolleisuuden riskin välisestä yhteydestä selittyi osallistujien paremmalla liikkumiskyvyllä. Sosiaalisesti aktiivisemmilla ikäihmisillä saattaa olla parempi liikkumiskyky. Toisaalta sekä kollektiivinen että produktiivinen sosiaalinen aktiivisuus voivat ylläpitää liikkumiskykyä, sillä useat sosiaalisen aktiivisuuden muodot sisältävät myös fyysisiä aktiivisuutta.

Tulosten mukaan parempi kognitiivinen kyvykkyys ja vähäisempi depressiivisten oireiden määrä selittivät aktiivisempaa osallistumista kollektiivisiin ja produktiivisiin sosiaalisiin toimintoihin. Depressiiviset oireet olivat myös yhteydessä sosiaalisten suhteiden kokemiseen. Niillä tutkittavilla, joilla oli enemmän depressiivisiä oireita ja yksinäisyyden kokemusta lähtötilanteessa, koetun yhteisyyden kokemukset olivat vähäisempiä tutkimuksen seurantatilanteessa. Sosiaalista toiminnoista luopuminen voi olla ensimmäisiä merkkejä heikentyneistä kognitiivisista toiminnoista. Toisaalta heikentynyt kognitiivinen kyvykkyys saattaa vaikeuttaa kulkemista paikasta toiseen ja lisätä eksymisen vaaraa.

Masennusoireet puolestaan saattavat johtaa aloitekyvyttömyyteen kodin ulkopuolisiin toimintoihin osallistumisessa.

Tulokset osoittivat lisäksi, että koetun yhteisyyden ulottuvuuksista suurempi kiintymyksen ja hoivan mahdollisuuden kokemus tutkimuksen lähtötilanteessa ennustivat vähäisempää masennusoireiden määrää kuuden kuukauden seurannassa. Turvallisuuden ja rakkauden tunnetta sisältävät ihmissuhteet, kuten esimerkiksi suhteet puolisoon ja läheisiin ystäviin, tuottavat kiintymyksen tunnetta. Kiintymyksen tunne ja toisen ihmisen hyvinvoinnista vastuussa olemisen kokemus saattavat lisätä oman merkityksellisyyden ja elämän tarkoituksen kokemusta ja siten vähentää masennusoireiden ilmaantumisen riskiä (Taylor & Turner 2001; Boman et al. 2015; Van der Heyden, Dezutter & Beyers 2015).

Tulosten mukaan sosiaalisella interventiolla ei ollut vaikutusta masennusoireisiin, alakuloon ja yksinäisyyden kokemiseen. Yksinäisyys ja alakulo helpottuivat jossain määrin ajan kuluessa ja myönteinen muutos havaittiin sekä koe- että kontrollisryhmäläisillä. Erityisesti niiden osuus, jotka raportoivat kokevansa yksinäisyyttä ja alakuloa silloin tällöin, väheni ja niiden, jotka raportoivat kokevansa näitä harvoin tai ei lainkaan, lisääntyi. Pitkäkestoisempaa yksinäisyyttä voi olla vaikea lievittää, sillä siihen vaikuttavat monenlaiset taustatekijät. Yksinäisyys voi liittyä puutteellisten sosiaalisten suhteiden lisäksi sosiaalisessa verkostossa tapahtuneisiin muutoksiin, vaikeuksiin sosiaalisessa vuorovaikutuksessa, persoonallisuuden piirteisiin tai eksistentiaalisiin kysymyksiin. Kaikki tutkimukseen osallistuneet kävivät neuvojan luona kerran ja neuvojan kanssa käyty keskustelu on saattanut auttaa tutkittavia tiedostamaan sosiaaliin suhteisiin ja sosiaaliin tarpeisiin liittyviä näkökulmia ja lisäämään omaa aktiivisuuttaan kodin ulkopuolella. On tärkeää kuitenkin muistaa, että osa yksinäisyydestä ja alakulosta kärsivistä ikäihmisistä tarvitsee pidempikestoista ja intensiivisempää apua ongelmiensa lievittämiseksi.

Sosiaalinen interventio lisäsi sosiaalisen liittymisen tunnetta interventoryhmään osallistuneilla ja muutos oli samansuuntainen kaikissa intervention alaryhmissä. Sosiaalinen liittyminen viittaa kokemukseen, että ympärillä on ihmisiä, jotka ovat kiinnostuneita samoista asioista ja jakavat samankaltaisia huolia. Ryhmissä saatava vertaistuki ja keskustelut neuvojan kanssa ovat todennäköisesti tuottaneet emotionaalista tukea ja lisänneet hyväksyttynä olemisen ja johonkin kuulumisen kokemusta (ks. Leary & Kelly 2009).

Kollektiivinen ja produktiivinen sosiaalinen aktiivisuus saattavat hidastaa ikäihmisten terveyden heikkenemistä. Aktiivisempi osallistuminen sosiaaliin toimintoihin vaatii kuitenkin myös terveystarpeita. Vähäinen osallistuminen sosiaaliin toimintoihin, puutteet koetun yhteisyyden eri ulottuvuuksissa, yksinäisyyden kokeminen ja suurempi masennusoireiden määrä esiintyvät usein samanaikaisesti. Lisääntynyt sosiaalinen aktiivisuus ei kuitenkaan välttämättä johda tilanteen paranemiseen edellä mainituissa psykososiaalisissa tekijöissä.

Avainsanat: sosiaalinen aktiivisuus, yksinäisyys, koettu yhteisyys, kuolleisuus, masennusoireet, ikäihmiset

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ORIGINAL PUBLICATIONS

I

DOES SOCIAL ACTIVITY DECREASE RISK FOR INSTITUTIONALIZATION AND MORTALITY IN OLDER PEOPLE?

by

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Does social activity decrease risk for institutionalization and mortality in older people?

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Abstract

Objectives: Social inactivity predicts adverse health events, but less is known about how different dimensions of social activity are related to health. The aim of this study was to investigate collective (e.g. cultural and organizational activities) and productive (e.g. helping others) social activity as predictors of risk for mortality and institutionalization in old age.

Methods: 1181 community-living people aged 65- to 84 years at baseline were interviewed face-to-face as part of the Evergreen project, in Jyväskylä, Finland in 1988. Time to institutionalization and mortality were analyzed in separate models for proportional hazard regression on mortality and competing risks analysis on institutionalization and mortality.

Results: At follow-up approximately 17 years later 22% of persons were institutionalized and 71% had died. When sociodemographics, health, functioning, and intensity of physical activity were controlled for, collective social activity reduced risk for mortality and initially for institutionalization, although this latter effect diminished over time.

Discussion: Collective social activity may be associated with a reduced risk for mortality and institutionalization in older people. Further studies on the mechanisms underlying the association between social activity and health are needed.

Keywords: social activity, institutionalization, mortality, older people

INTRODUCTION

Social relations and interaction with other people are an important part of the everyday life and well-being of older people. A considerable body of empirical evidence has been amassed on the association between social participation and decreased risk for health deterioration, including mortality (e.g. (Dalgard & Lund Haheim, 1998; Glass, Mendes de Leon, Marottoli, & Berkman, 1999; Sabin, 1993; Steinbach, 1992; Walter-Ginzburg, Blumstein, Chetrit, & Modan, 2002; Yasuda et al., 1997) and, to a lesser extent, institutionalization (Pynnonen, Sakari-Rantala, & Lyyra, 2007; Steinbach, 1992).

Despite the attention paid to the influence of social relationships on health, differing concepts and measures have been used across studies (Avlund et al., 2004). Social engagement or participation can be seen as one of the primary pathways through which social networks assert influence on health of people (Berkman, Glass, Brissette, & Seeman, 2000). On the other hand, social activity can be viewed as a type of social engagement, if we use social engagement as an umbrella concept for the various components of an individual's social behavior and social structure (Mendes de Leon, 2005) and consider it as a part of the broader participation of persons in the social milieu (Morgan et al., 1987). Earlier studies have shown that various dimensions of social relations may influence health in different ways (Beland, Zunzunegui, Alvarado, Otero, & Del Ser, 2005; Gleit et al., 2005; Mendes de Leon, Gold, Glass, Kaplan, & George, 2001). For example, going to church/temple, doing voluntary work, and seeing friends and neighbors and talking with them on the phone have been found to decrease mortality risk in older people, whereas a similar relationship has not been found for household and kin relationships (Sabin,

1993; Yasuda et al., 1997). Thus, it is important also to study whether various types of social activity are related to adverse health events in different ways.

It has been suggested, on the bases of their content, context, and resources required for participation, that collective and productive social participation are independent forms of activity (Bukov, Maas, & Lampert, 2002). In accordance with this theoretical conceptualization, Bukov and colleagues see that in collective social participation an individual acts as a group member sharing his/her time with others. In productive social participation individuals additionally share resources such as special abilities and competencies. Both activities may in part yield a similar advantage e.g. formation and affirmation of person's self-concept (see (Mannell & Kleiber, 1997).

Collective social activity may be seen at least partly as a way of satisfying the social need of affection, which is fulfilled by relationships that, for example, give a person the feeling that he/she is liked, trusted and accepted, understood, that others like to be either emotionally or physically close to him/her (Steверink & Lindenberg, 2006), and that give one experiences of mattering (Taylor & Turner, 2001) and a sense of belonging to a group with whom one shares common interests and social activities (Mancini & Blieszner, 1992). Thus, collective social activity includes leisure activities which are typically carried out in a context offering opportunities for socializing, interaction, and sharing experiences (Mannell & Kleiber, 1997), and function as a source of emotional support. Receiving emotional support and not feeling oneself as lonely have been found to increase mortality risk (Penninx et al., 1997). Mattering to others may decrease depressive symptoms (Taylor & Turner, 2001) which have been found to be associated

with institutionalization (Miller & Weissert, 2000) and mortality in old age (Almeida, Alfonso, Hankey, & Flicker, 2010; Sun, Schooling, Chan, Ho, & Lam, 2010).

Productive social activity may be seen mostly to satisfy the need of behavioural confirmation, which is achieved by relationships that give one the feeling of doing good things, doing things well, being a good person, being useful, contributing to a common goal, and being part of a functional group (Steverink & Lindenberg, 2006). Productive activity may also generate reassurance of worth and give an opportunity for nurturance (Weiss, 1973). Reassurance of worth refers to a sense of competence and esteem, and the opportunity to nurturance refers to being responsible for care of others. Greater feelings of usefulness and mastery are associated with lower mortality risk in older adults (Gruenewald, Karlamangla, Greendale, Singer, & Seeman, 2007; Gruenewald, Karlamangla, Greendale, Singer, & Seeman, 2009; Penninx et al., 1997). Self-efficacy may prevent worsening of functional ability (Mendes de Leon, Seeman, Baker, Richardson, & Tinetti, 1996) which in turn is a risk factor for institutionalization and mortality (Miller & Weissert, 2000).

In all, we expected that collective and productive social activities represent different dimensions of social activity, because the resources people give when participating in these activities, their orientation towards them, and the needs met by participation in them differ. Furthermore, we expected that collective and productive social activities are associated with risk for health outcomes such as mortality and institutionalization, but that the effect of these two dimensions of social activity on health outcomes may vary, because different social needs activities satisfy may affect the risk through distinct pathways.

The objectives of the present study were to examine the association 1) between collective and productive social activity and mortality over a follow-up of 17 years, and 2) between collective and productive social activity and institutionalization over a follow-up period of 16 years, in 65- to 84-year-old Finnish people.

METHODS

Study population and data collection

Data were gathered as part of a multidisciplinary, longitudinal research program, the Evergreen project, the aim of which is to study the health and functional capacity of older residents in the city of Jyväskylä, Finland (Heikkinen, 1990; Heikkinen, 1998). The population in the study consisted of people born in 1904–23, who were residents of Jyväskylä on February 1st 1988. Of this group 1 600 persons were randomly sampled for recruitment into the study with oversampling of those aged 75 years or older at baseline. Of these people, 74 persons were excluded (36 persons had died between the sampling and beginning of the baseline study, 33 had been placed in a nursing home or hospital before the interview and 5 had moved). 1 224 people took part in the baseline interview. Among the non-respondents (n=302), reasons for refusing included unwillingness to participate in the study (n=158), health problems (n=57), and other reasons (n=60), or the person was not reached (n=27). We excluded from all analyses 21 persons who had died during 1988, less than one year from the baseline, and 21 persons who had a large amount of missing data in their baseline questionnaire. Thus our analyses were based on 1 181 individuals. Of this number, 62 % had complete data on the baseline variables. Among the 38 % of the study participants with missing baseline values, the mean of the portion of missing values

was 13 percent. All participants had complete data on follow-up of vital status and institutionalization.

Measures

Outcome data: In Finland, long-term care is carried out in health centre inpatient wards and nursing homes. A participant was classified as institutionalized if he/she had officially been deemed in need of long-term care; this decision is usually made when the period of care has lasted at least three months and it needs to be continued. Of those officially deemed in need of long-term care, a few may recover and be discharged later, but most remain institutionalized for the rest of their lives. Data on long-term care decisions were drawn from the local registers of health care centres and nursing homes. *Time to the long-term care decision* was calculated as the number of days from the baseline interview date to either the date of the long-term care decision, the date of death, or the end of the follow-up period (December 31st 2004). Dates of death obtained from the population register included all the deaths that occurred between January 1988 and February 2005. *Survival time* was calculated as the number of days from the baseline interview date to either the date of death or the end of the follow-up period (February 8th 2005). Survival times were censored at the end of follow-up.

Social activity: Social activities were queried at baseline in a structured interview. Based on the theoretical conceptualisation outlined in the introduction and its confirmation by exploratory factor analysis, we divided social activity into collective and productive social activities (Table 1). To formulate *collective social activity* variable participants were asked about their involvement in different kinds of hobbies, such as cultural hobbies (visiting the theatre, going to concerts or movies, etc.), artistic hobbies (singing in a choir, playing a musical instrument,

painting, etc.), acting in organizations, congregational activities, and studying. The response options were regularly, occasionally or not at all. For dancing, the frequency of participation was categorised as at least once a month, less than once a month, or not at all. For physical activity pursued in group, the frequency of participation was categorised as at least once a week, once or twice a month or less, or not at all. For domestic and foreign travel, the response options were few times a year, once a year or less, or not at all. Overall participation was the sum score of all nine activities. To formulate *productive social activity* variable the participants were asked about giving help to relatives, friends or neighbours in cooking, shopping, child caring, cleaning, going for a walk, washing clothes, going to the bank or post office, or in some other way. Frequency of helping in the above-mentioned activities was categorised as at least once a month, less than once a month, or not at all. We calculated a composite measure of productive social activity in the same way as for collective social activity. The activities with less clear loading pattern in the social activity factors included in the sum score on the basis of conceptual relevance.

[table 1 about here]

Adjusting covariates included age, full-time education (in years), perceived economic situation (a 5-point scale from very good to very poor), and marital status (married or cohabiting vs. single, widowed, divorced). Sex was taken into account by allowing baseline hazard to vary by sex. Morbidity was assessed according to self-reported physician-diagnosed chronic diseases lasting more than 3 months. Diseases were classified by a physician afterwards according the ICD-9. Serious diseases included ischemic heart disease, cardiac insufficiency, heart infarction, cerebral infarction, and chronic obstructive pulmonary disease (Lyyra & Heikkinen, 2006). The ability to perform essential self-care tasks was measured by asking if a person had difficulties in eating,

getting in/out of bed, dressing, bathing, and toileting. Mobility was measured by asking about ambulating indoors, outdoors, and climbing stairs. The response options for these were categorized as “yes, without difficulties”, scored 0, “yes, but has difficulties”, scored 1, or “not able/needs somebody to help”, scored 2. Summary measures were computed for self-care and mobility. To measure cognitive functioning, we used the Mini-D test (Erkinjuntti, Laaksonen, Sulkava, Syrjalainen, & Palo, 1986). The test has been developed for screening dementia, but it can be used to assess essential cognitive functions such as orientation, memory and learning, reasoning, visualization, and problem-solving (Takkinen & Ruoppila, 2001). We used a summary score of the 35 items of the Mini-D test. Larger score indicates better cognitive functioning and the scale maximum is 43. Depressive symptoms were screened using a modified version of Beck’s depression scale, which measures self-rated and experienced depressive symptoms (Lampinen, Heikkinen, Kauppinen, & Heikkinen, 2006). Every item is rated 0–3, with ascending scores indicating greater severity of symptoms. We used a summary score of the scale. Intensity of physical exercise was measured on a 7-point scale from “moving about only minimally to carry out everyday chores” to “engaging in competitive sports several times a week” (Hirvensalo, Lintunen, & Rantanen, 2000). The variable distribution was concentrated at three points of the distribution and, hence, it was re-categorized as follows: “moving about only minimally to carry out everyday chores”, “light physical activity one to two or several times a week”, and “at least exercise causing breathlessness and sweating one to two times a week”.

Statistical analysis

Mann-Whitney *U* test and Kruskal-Wallis test were used to compare the differences in means of the continuous baseline measurements between non-survivors and survivors and non-institutionalized, deceased, and surviving participants. For the dichotomous variables, we used

the chi-square test. For the outcome of time to mortality we used a proportional hazard regression model for mortality risk (Cox, 1972). Competing risks models (Fine & Gray, 1999) were used to analyse time to institutionalization, which is an extension of the proportional hazards model enabling focus on the sub-distribution of risk for institutionalization and treating mortality risk as an adjusting outcome. We built a hierarchical set of models for both outcomes by adding one set of baseline indicators of sociodemographics, psychological and physiological health and functioning at time to assess whether they might account for possible associations between social activity, mortality, and institutionalization. These indicators were selected based on earlier studies. We calculated the relative reduction in risk for regression coefficient, b_k , among a total of p regression coefficients as:

$$RRR_k = [\exp(|b_k|) - 1], \quad k = 1, \dots, p,$$

where $\exp(|b_k|)$ is the hazard ratio calculated from the absolute value of the regression coefficient of predictor k . We report reduction in risk as a percentage. For both models we performed checks on the assumption of proportionality of hazards as described in Grambsch and Therneau (Grambsch & Therneau, 1994) and we used their plotting technique based on Schoenfeld-residuals to investigate time-dependent effects. We also performed residual checks for the functional form of covariates and influential observations as described in Therneau and Gramsch ((Therneau & Grambsch, 2000). In preliminary analyses we found significant differences in baseline hazards for sex ($p < 0.001$). However, in the event-time regression models the effects of covariates were not materially different between the sexes, so that in the main analyses sex was taken into account by allowing the baseline hazard to vary by sex. Exploratory factor analysis for categorical variables was performed with MPLUS version 5.21 (Muthén &

Muthén, 1998-2009), and the other analyses were performed with R version 2.11.0 (R Development Core Team., 2010). We imputed missing values using the available variable information with the MI procedure in SAS for Windows, version 9.1.

RESULTS

Table 2 presents the baseline data for the whole sample and by institutionalization and vital status. Mean (standard deviation) collective social activity was 4.70 (2.95) and mean productive social activity 1.48 (2.38). Collective social activity was more common than productive social activity, as only 6 percent of the participants did not participate in any collective social activity at all, whereas for productive social activity the corresponding proportion was 55 percent.

Collective and productive social activity correlated slightly ($r = 0.163$). At the 17-year follow-up 834 persons (71 %) had died. At the 16-year follow-up, 262 persons (22 %) were institutionalized and 605 persons (51 %) had died without first being institutionalized. Those not institutionalized or deceased during the follow-up time were more active in participating in collective social and productive social activities, were younger, had longer education, and evaluated different dimensions of their health as good than their counterparts. Mean perceived economic situation was not associated with institutionalization or mortality status at end of follow-up. A slightly larger proportion of the institutionalized participants were women than the overall proportion of women in the entire cohort and a slightly larger proportion of the deceased participants were men than the overall proportion of men in the entire cohort. People who were married or cohabitating were less likely to have been institutionalized or to have died by the end of the follow-up. Those participating in physical activities were less likely to have been institutionalized or to have died during the follow-up.

[table 2 about here]

The results of the proportional hazard regression analyses revealed that both collective and productive social activity was associated with reduced mortality risk when the model was controlled for age and the baseline hazard was allowed to vary by sex (model 1, table 3). A unit - increase in collective social activity lowered mortality risk by 8 percent and productive social activity by 4 percent. Adjusting the raw model with marital status, education and perceived economic situation (model 2), indicators of psychological and physiological health (model 3) or intensity of physical activity (model 4) did not change the effect of collective social activity on mortality risk. However, productive social activity was no longer a significant predictor of decreased mortality risk after adjusting the model for number of serious illnesses, difficulties in self-care tasks and mobility, cognitive functioning, and depressive symptoms (model 3 and 5). Collective social activity was related to lower mortality risk even after accounting for all adjusting covariates (model 5): a unit -increase in collective social activity lowered mortality risk by 4 percent. Because seventeen years of follow-up time is a relatively long time, it is reasonable to consider whether the baseline social activity measures have an influence on risk for death throughout the follow-up period. Tests of the proportionality assumption showed that neither the effect of collective ($p = 0.088$) nor the effect of productive ($p = 0.342$) social activity on mortality risk was time-dependent. Thus, we can conclude that influence of collective social activity remains statistically stable over time in the models for mortality risk.

[table 3 about here]

In the initial models, time-dependence was not accounted for and we observed no significant association in any of the hierarchical models (full-model HR 1.03; 95 % CI 0.98–1.08) between collective social activity and risk for institutionalization when mortality risk was also taken into account. However, the proportionality test on the influence of collective social activity on institutionalization risk indicated time-dependency of the effect ($p < 0.001$), and when the interaction of collective social activity with follow-up time was taken into account, collective social activity had a significant main effect on institutionalization risk, but productive social activity, in turn, did not explain the risk for institutionalization. At the beginning of the follow-up (at time 0 days) a unit-increase in collective social activity lowered institutionalization risk by 30 percent when age was controlled for (model 1, table 4). In this early follow-up time, collective social activity was associated with risk for institutionalization although other covariates were added into the base model. In the full adjusted model, a unit-increase in collective social activity lowered the initial institutionalization risk by 27 percent (model 5). Testing the interaction with time indicated that the effect of collective social activity on risk for institutionalization changed over time (interaction coefficient of collective social activity and time $b = 0.000077$, $s.e.(b) = 0.000014$, $p < 0.001$). To illustrate the change over time of the effect of collective social activity, Figure 1 shows the analysis of time-dependency in the form of Schoenfeld-type residuals against time, where we also plotted a LOESS curve with 95 % confidence intervals to aid in interpretation. The figure shows that at baseline and up to about 2500 days into follow-up the regression coefficient of collective social activity is significant and negative, indicating a protective effect of collective social activity. After this, the risk begins to rise, where the LOESS-curve exhibiting a slightly increasing slope until the end of the follow-up period, so that after about 4 000 days into follow-up there is an increased risk for those collectively active at baseline. Removing the outliers with residual larger than the absolute value of five did not materially

change the results. Based on the model of Table 4, we calculated that the hazard estimates for institutionalization at 1000, 3250 and 5500 days were 0.85, 1.01 and 1.19, respectively, when the other covariate values were held at their means (continuous variables) or zero (discrete variables).

[table 4 about here] [figure 1 about here]

Finally, we excluded from the analyses those participants who died or were institutionalized within the first two years of follow-up. This did not materially change the results. Furthermore, after omitting those persons who had the worst mobility (mobility score ≥ 4) from the analyses and excluding travelling, dancing, and physical activity pursued in groups from collective social activity the association between collective social activity and risk for mortality and institutionalization remained statistically significant.

DISCUSSION

Participation in collective and productive social activities correlated highly with decreased risk for mortality, but part of the association was explained by the better health of the productively socially active participants. Nevertheless, collective social activity correlated with lower risk for mortality even after extensive adjustments for potential confounders. The effect of collective social activity on risk for institutionalization was strongest at the beginning of the study, while towards the end of the follow-up period a reverse trend was observed.

Other studies, which to some extent have used comparable measurements of collective social activities, have reported results similar to those of the present study. Participation in social

activities i.e. church attendance, going to the movies, restaurants, or sport events, travelling, playing cards, games, bingo, or participation in social groups has been found to reduce mortality risk in older people (e.g. (Glass et al., 1999). Instead, we did not find an association between productive activity and risk for mortality or institutionalization when health-related factors were taken into account. According to Herzog and colleagues (Herzog, Franks, Markus, & Holmberg, 1998) leisure activities brought about experiences of a social as well as an agentic, competent sense of self while productive activities were primarily related to an agentic self. Thus, leisure activities may have a more important role for health and well-being than productive activities. Productive social activity, in general, may become personally important. However, possibly due to the feelings of social responsibility, providing informal help may result in less social recognition (Li & Ferraro, 2005). Instead, participation in leisure or collective social activities enables a person to maintain a sense of choice and encourages self-determination (Mannell & Kleiber, 1997), 137) more than providing informal help. However, some other studies have shown that providing instrumental support to friends, relatives, and neighbors reduces mortality risk (Brown, Nesse, Vinokur, & Smith, 2003; Sato et al., 2008). In our study, low participation rates in the variables of helping other people may be a primary reason for the non-significant finding of productive social activity. Furthermore, giving help to other people captures only part of productive social activity. For example, we did not have information on emotional support or doing voluntary work which have are be associated with lower mortality risk (Harris & Thoresen, 2005; Musick, Herzog, & House, 1999).

There are several potential explanations for the present results. First, it is possible that people who engage in social activities are healthier than those who do not, which may explain their

lower risk for institutionalization and mortality. We adjusted our models for long-term illnesses, indicators of daily functioning, depressive symptoms and cognitive functioning assessed with validated scales. This attenuated the association between productive social activity and mortality, indicating that health indeed explained the association. However, the results for collective social activity did not materially change after adjustments, or after excluding those who died or were institutionalized during the first two years after the baseline or those who had the worst mobility. Consequently, it is unlikely that the better health status of those engaging in collective social activities would wholly explain their lower risk for institutionalization and mortality. It is possible that through various mechanisms participation in collective social activity may maintain health at a higher level, thus decreasing risk for institutionalization and mortality. Social activity may preserve physical functioning (Buchman et al., 2009), which in turn is associated with decreased risk for mortality (Buchman et al., 2009; Lyyra, Leskinen, & Heikkinen, 2005) and institutionalization (Miller & Weissert, 2000). Earlier studies have also shown that social activity or social engagement helps to preserve cognitive function (Beland et al., 2005; Gleib et al., 2005) and decrease the risk for dementia (Wang, Karp, Winblad, & Fratiglioni, 2002), which have been found to be associated with institutionalization, and mortality (Miller & Weissert, 2000). Other mechanisms may also be present. Earlier studies have shown that social participation may be associated with greater life satisfaction and sense of self-efficacy (Adelmann, 1994). Self-efficacy may prevent worsening of functional ability (Mendes de Leon et al., 1996) which in turn is a risk factor for institutionalization and mortality (Miller & Weissert, 2000). Greater feelings of mastery have also been found to reduce mortality risk in older adults (Penninx et al., 1997).

The change over time from a protective effect to an increased risk factor for institutionalization risk observed for participation in collectively social activities deserves some discussion. In the

1990s, during the follow-up period of this study, the social- and health service in Finland underwent structural reform, in favour of outpatient care. The number of recipients of informal care has increased and long-term institutional care has been replaced by sheltered housing with tailored services (the Ministry of Social Affairs and Health, 2006). Most of those in institutional care are in need of continuous or almost continuous care because of their poor health status. Collective social activity, indicating expansion of active life, can be assumed to be a health - enhancing factor which may contribute to the compression of morbidity (see (Fries, 2000), and thus delay the need for care till the very end of life. Alternatively, as those who were institutionalized or deceased in this study had worse health status than the surviving individuals, it is conceivable that among those who had meaningful social activities, being obliged to give them up along with deterioration in health may increase the risk for institutionalization.

The strengths of this study are a representative population-based sample of older people living in the community, data gathering through face-to-face interviews, a high response rate (80 %), and long follow-up times. Furthermore, in Finland register-based data on deaths and long-term care decisions are reliable with complete coverage. The study was part of a wider multidisciplinary research project, and hence we were able to adjust our models for several important and interesting variables. A potential limitation of this study is that self-reports of diseases are prone to recall bias, particularly in illnesses perceived as non-threatening and not affecting daily functioning. These illnesses may nevertheless increase the risk for deterioration in health. However, we do not believe that we have substantially underestimated the disease burden at baseline, because we were able to adjust our models for physical activities of daily life, mobility, depressive symptoms and cognitive functioning in addition to self-reported physician-diagnosed diseases. Another potential important limitation is that there may be other meaningful social

activities not captured in our interview, such as informal social gatherings and volunteering. In particular, the effect of productive social activity on health indicators needs further study with more appropriate measures. As noted in the introduction, the distinction between the two forms of social activity is problematic because these dimensions are not clearly separable. The third potential limitation is that our analysis is based on the data which were collected in the late 1980'es. Consequently, some of the study items may not be consistent with current knowledge on the topic. For participation in collective social activities, we were not able to differentiate whether the person who responded 'yes' did the activity alone or in a group. However, we can be fairly sure that e.g. going to cultural events, singing, practicing visual art, or studying is for many older persons carried out in a social context. Community-music and art classes are highly developed in Finland, and for example the Third Age University has been an important actor in old age education in Finland and especially in Jyväskylä. Inclusion of these activities in the variable describing collective social activity may have caused some measurement error, but leaving these out would definitely have led to underestimation of participation in collective social activities.

The study broadens understanding of collective and productive social activity and their relation to two major outcome variables describing age-related health events. We have produced new knowledge on the association of social activities and risk for institutionalization. The results concerning collective social activity and mortality can be generalized to community-dwelling older people. Although social networks are contextually bound, meaning that the characteristics of networks associated with the well-being of older people may differ in different regional settings (Litwin, 2010), the phenomenon of social activity as a contributor to the health of older people can be viewed as alike everywhere (see (Holt-Lunstad, Smith, & Layton, 2010; Seeman,

2000). However, the results concerning institutionalization may be more contextually bound, since health care systems are different in different countries. Placing the elderly in long-term care has traditionally been more common in Finland and the other Nordic countries than e.g. in Southern Europe or East Asia, where reliance on the family as the care provider has thus far been the norm.

Conclusion: Collective social activity may be associated with a reduced risk for mortality and institutionalization, indicating that promoting social activity can maintain and enhance health in old age. Socially inactive older people form a risk group, and hence there is need to create more opportunities for them to engage in social activity. More research on the factors mediating social activity and health is needed in order to achieve a deeper understanding on the phenomenon.

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Author contributions

K.Pynnönen: Conception and design, drafting the manuscript, acquiring the funding for conducting the research. T.Törmäkangas: Contribution to the design of the study, data analysis, critical revision for important intellectual content. R-L.Heikkinen: designing the measurements of social activity, critical revision for important intellectual content. T.Rantanen: Critical revision for important intellectual content. T-M.Lyyra: Contribution to the design of the study, critical revision for important intellectual content.

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Table 1. Factor loadings of exploratory factor analysis and residual variances for dimensions of social activity (n = 1 181).

	Collective social activity	Productive social activity	Residual variances
	Factor loadings	Factor loadings	
Artistic hobbies	0.45	-0.03	0.80
Cultural hobbies	0.70	-0.01	0.51
Organizational participation	0.61	-0.07	0.64
Congregational activities	0.05	0.05	0.99
Studying	0.50	0.14	0.70
Travelling in home country	0.72	-0.04	0.50
Travelling abroad	0.69	-0.13	0.55
Dancing	0.60	0.03	0.63
Physical activity pursued in groups	0.38	-0.10	0.87
Helping in cooking	-0.20	0.81	0.39
Helping in shopping	0.09	0.85	0.23
Helping in child caring	0.26	0.23	0.85
Helping in cleaning	-0.08	0.90	0.23
Helping in going for a walk	0.20	0.43	0.74
Helping in washing clothes	-0.13	0.88	0.26

Helping in going to the bank or post office	0.16	0.77	0.31
Helping in some other way	0.25	0.16	0.89

Table 2. Proportions and means (standard deviations) of the baseline characteristics in whole sample and by vital status and institutionalization/vital status.

	Whole	Deceased in 2005		Institutionalized or deceased in 2004				
	sample	Yes	No	Instit.	Deceased	Surviving		
	n = 1 181	n = 834	n = 347	n = 262	n = 605	n = 314		
		(71 %)	(29 %)	(22 %)	(51 %)	(27 %)		
	mean (sd)	mean (sd)	mean (sd)	<i>p</i> -value	mean (sd)	mean (sd)	mean (sd)	<i>p</i> -value
Collective social activity	4.70 (2.97)	4.36 (2.97)	5.52 (2.82)	<0.001	4.52 (3.18)	4.38 (2.89)	5.47 (2.81)	<0.001
Productive social activity	1.48 (2.37)	1.27 (2.20)	1.98 (2.67)	<0.001	1.08 (1.98)	1.37 (2.30)	2.02 (2.68)	<0.001
Age (in years)	72.9 (5.40)	74.4 (5.16)	69.3 (4.11)	<0.001	75.0 (4.87)	74.0 (5.27)	69.0 (3.98)	<0.001
Education (in years)	6.59 (3.41)	6.31 (3.27)	7.27 (3.64)	<0.001	6.27 (3.50)	6.40 (3.28)	7.23 (3.50)	<0.001
Number of serious illnesses	0.43	0.50	0.27	<0.001	0.43	0.51	0.27	<0.001

	(0.61)	(0.64)	(0.48)		(0.61)	(0.65)	(0.48)	
Number of difficulties in self-care	0.43	0.51	0.22	<0.001	0.63	0.45	0.21	<0.001
	(1.03)	(1.14)	(0.65)		(1.19)	(1.10)	(0.65)	
Number of difficulties in mobility	0.80	0.99	0.36	<0.001	1.00	0.95	0.36	<0.001
	(1.22)	(1.31)	(0.82)		(1.33)	(1.28)	(0.83)	
Cognitive functioning	36.3	35.5	38.2	<0.001	34.6	36.0	38.3	<0.001
	(5.23)	(5.52)	(4.28)		(5.94)	(5.22)	(4.29)	
Depressive symptoms	3.26	3.47	2.75	0.003	3.44	3.41	2.82	0.072
	(3.29)	(3.48)	(2.74)		(3.41)	(3.46)	(2.79)	
Perceived economic situation	2.57	2.59	2.52	0.104	2.58	2.60	2.50	0.118
	(0.72)	(0.73)	(0.71)		(0.73)	(0.73)	(0.70)	
	%	%	%		%	%	%	
Women	65.6	63.2	71.5	0.007	73.7	59.7	70.4	<0.001
Married or cohabitated	44.6	41.8	51.3	0.003	29.0	46.8	53.5	<0.001
Intensity of physical exercise				<0.001				<0.001
-only in everyday chores	24.5	28.5	14.7		27.1	28.8	14.0	
-light physical exercise	57.7	57.3	58.8		59.2	56.0	59.9	

-at least exercise causing breathlessness 19.0 14.1 26.5 13.7 15.2 26.1
and sweating 1-2 times a week

Table 3. Hierarchical models of the association between social activity and 17-year **mortality** risk among 65- to 84-year-old people: Hazard ratios (HR) and 95 % confidence intervals (CI) (n = 1 181).

	Model 1	Model 2	Model 3	Model 4	Model 5
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Participation in collective social activities	0.93 (0.91-0.95)	0.93 (0.91-0.95)	0.96 (0.93-0.98)	0.95 (0.92-0.97)	0.96 (0.94-0.99)
Participation in productive social activities	0.96 (0.93-0.99)	0.96 (0.93-0.99)	0.98 (0.95-1.02)	0.96 (0.94-1.00)	0.99 (0.95-1.02)
Age (in years)	1.11 (1.10-1.13)	1.11 (1.09-1.13)	1.09 (1.08-1.11)	1.11 (1.09-1.12)	1.09 (1.08-1.11)
Marital status (married vs. no married)		0.91 (0.78-1.07)			0.94 (0.80-1.10)
Education		1.04 (0.90-1.21)			1.12 (0.96-1.30)
Perceived economic situation		1.07 (0.97-1.17)			1.00 (0.90-1.10)
Number of serious illnesses			1.22 (1.10-1.37)		1.23 (1.10-1.37)
Number of difficulties in self-care			0.97 (0.90-1.06)		0.98 (0.90-1.06)
Number of difficulties in mobility			1.22 (1.14-1.30)		1.19 (1.10-1.27)
Cognitive functioning			0.97 (0.96-0.99)		0.97 (0.96-0.98)

Depressive symptoms	1.00 (0.98-1.03)	1.00 (0.98-1.02)
Intensity of physical exercise		
-light phys act vs. only in everyday chores	0.75 (0.64-0.88)	0.87 (0.73-1.03)
-at least exercise causing breathlessness and sweating 1-2 times a week vs. only in everyday chores	0.58 (0.46-0.74)	0.71 (0.55-0.92)

Table 4. Hierarchical models of the association between social activity and 16-year mortality-adjusted **institutionalization** among 65- to 84-year-old people: Hazard ratios (HR) and 95 % confidence intervals (CI) (n = 1 181).

	Model 1	Model 2	Model 3	Model 4	Model 5
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Participation in collective social activities	0.77 (0.69-0.85)	0.77 (0.69-0.85)	0.79 (0.71-0.89)	0.77 (0.69-0.86)	0.79 (0.71-0.88)
Interaction : time*collective social activity	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Participation in productive social activities	0.94 (0.88-1.01)	0.94 (0.89-1.01)	0.95 (0.89-1.02)	0.95 (0.89-1.01)	0.95 (0.89-1.02)
Age (in years)	1.09 (1.06-1.11)	1.07 (1.05-1.10)	1.07 (1.05-1.10)	1.09 (1.06-1.11)	1.06 (1.04-1.09)
Marital status (married vs. no married)		0.55 (0.42-0.73)			0.55 (0.42-0.73)
Education		0.89 (0.68-1.17)			1.03 (0.78-1.37)
Perceived economic situation		1.03 (0.87-1.22)			1.04 (0.87-1.24)
Number of serious illnesses			0.95 (0.76-1.19)		0.94 (0.75-1.18)
Number of difficulties in self-care			1.13 (0.99-1.29)		1.13 (0.99-1.29)
Number of difficulties in mobility			0.98 (0.85-1.13)		0.96 (0.83-1.12)
Cognitive functioning			0.96 (0.93-0.98)		0.96 (0.93-0.98)
Depressive symptoms			0.99 (0.95-1.03)		0.98 (0.94-1.02)
Intensity of physical exercise					
-light phys act vs. only in everyday chores				1.03 (0.77-1.39)	1.05 (0.75-1.47)

-at least exercise causing breathlessness and
sweating 1-2 times a week vs. only in
everyday chores

0.82 (0.54-1.26) 0.90 (0.57-1.44)

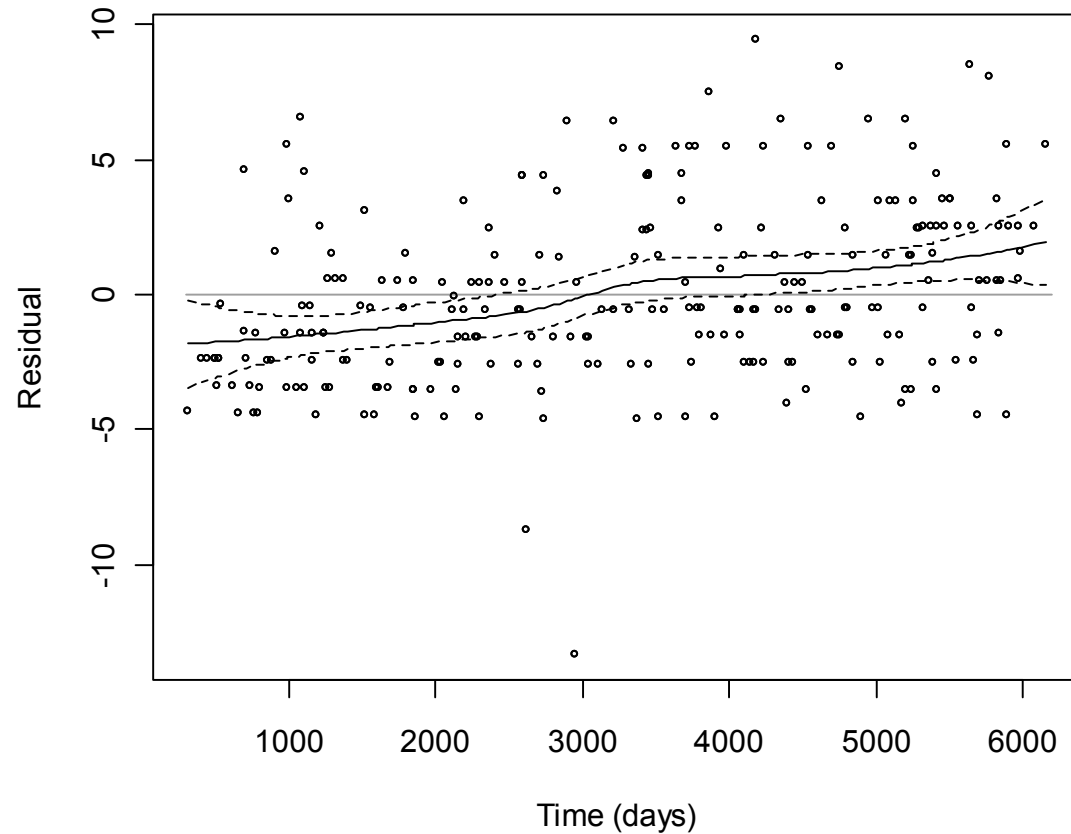


Figure 1. Assessment of time-dependence with Schoenfeld-type residuals plotted against time for collective social activity in the competing risks model for institutionalization. The solid black line is a LOESS fit line, horizontal grey line indicates the zero value for the regression coefficient and the dashed lines refer to the 95 % confidence intervals of the LOESS fit line.

II

DO MOBILITY, COGNITIVE FUNCTIONING, AND DEPRES- SIVE SYMPTOMS MEDIATE THE ASSOCIATION BETWEEN SOCIAL ACTIVITY AND MORTALITY RISK AMONG OLDER MEN AND WOMEN?

by

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Do mobility, cognitive functioning, and depressive symptoms mediate the association between social activity and mortality risk among older men and women?

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196.

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Abstract

Background: Social activity and health correlate in old age, but less is known about what explains this association. The aim of this study was to investigate whether mobility, cognitive functioning, and depressive symptoms mediate the association between social activity and mortality risk, or whether they alternatively should be considered as prerequisites for social activity in older Finnish men and women.

Methods: In 1988, 406 men and 775 women aged 65-84-years took part in face-to-face interviews about their health, socioeconomic status, and social activities. Confirmatory factor analyses were used to form latent variables describing collective and productive social activity. Latent variable models were used to investigate the possible pathways between social activity, mobility, cognitive functioning, depressive symptoms, and mortality risk.

Results: In the 21-year follow-up, 89% of men and 81% of women had died. Collective and productive social activity correlated with a lower risk for mortality among men and women. Part of the association between social activity and mortality was mediated by mobility. Cognitive functioning and depressive symptoms were not mediators in the association. Instead, good cognitive functioning and having less depressive symptoms were prerequisites for participating in collective social activity among men and women. Among men, good cognitive functioning, and among women, good cognitive functioning and having less depressive symptoms were prerequisites for productive social activity.

Conclusion: The health-enhancing influences of social activity may be partly explained by better mobility among persons who are socially active. Moreover, social activity may maintain mobility and thus decrease mortality risk, as many social activities also include physical activity. Better cognitive functioning and having less depressive symptoms should be considered as prerequisites for participating in social activities.

Keywords: Interpersonal relations, mortality, mobility limitation, cognition, ageing

INTRODUCTION

Social connections and interaction are important parts of everyday life of older people as they may generate well-being (Chappell and Badger 1989) and enable receiving and giving social support even after the health begins to decline (Penninx et al 1999). The social aspect is included in various leisure activities (hobbies), because they provide opportunities to form social connections and meet friends and acquaintances. Social activity has often been investigated as a combined measure including activities such as attending cultural and sporting events, religious services, organizational activities, going on trips, participation in social groups, visiting relatives and friends, doing voluntary work, and helping other people (e.g. (Krueger et al., 2009). Social activity has also been investigated as an interaction occurring in informal (such as telephone contact and getting together with family members, relatives, friends, and neighbours) and formal (e.g. meeting attendance, religious participation, volunteer work) contexts (Utz, Carr, Nesse, & Wortman, 2002). While the area of research on social activity and its influence on health have received considerable attention, there is still little consensus on the relevant constructs (Mendes de Leon, 2005). Distinctions between relevant constructs involve content, context, and consequences for the individual.

Based on the content and context of the activity, prerequisites required for participation, and consequences for the society, social activity has been conceptually divided into collective, productive, and political social participation (Bukov, Maas, & Lampert, 2002). In this paper our focus is only on the collective and productive aspects of the conceptual model. When participating in collective social activity, a person gives his/her time and acts together with other people. This kind of activity can also be seen as personal involvement in the community, in which the individual is more concerned with his or her own development and well-being (Broese van Groenou & Deeg, 2010). Productive social activity occurs when a person gives his/her time and is doing something for the well-being of another person or for common good. Doing volunteer work and helping others are examples of productive social activity (Bukov et al., 2002).

Also consequences for the person him/herself may vary depending on the type of the activity. Collective social activity includes leisure activities which are usually carried out in a context offering opportunities for socializing, interaction, and sharing experiences (Mannell & Kleiber, 1997), and function as a source of emotional support. Thus, collective social activity may enable interaction which provides a feeling of being liked, trusted and accepted, understood, provide the experience that others like to be either emotionally or physically close to him/her, and thus satisfy the social need of affection (Steverink & Lindenberg, 2006). As a consequence, a person may also undergo experiences of mattering (Taylor & Turner, 2001) and a sense of belonging to a group with whom one shares common interests and social activities (Mancini & Blieszner, 1992). Productive social activity may give feelings of doing good things, doing things well, being a good person, being useful, contributing to a common goal, and being part of a functional group, and thus satisfy the need of behavioural confirmation (Steverink & Lindenberg, 2006). Productive activity may also generate reassurance of worth, i.e. a sense of competence and esteem, and give an opportunity for nurturance which refers to being responsible for care of others (Weiss, 1973). Studies on distinct consequences of collective and productive social activities on cognitive functioning and mobility are rare, but it is conceivable that each type of activity includes both cognitive and physical stimulation and thus enhances cognitive functioning and mobility of older people.

Fulfilment of the above mentioned psychosocial or social needs may maintain and improve health of older people. The study by Penninx and colleagues (1997) showed that those who received emotional support and were not feeling lonely had reduced mortality risk. Mattering to others may decrease depressive symptoms (Taylor & Turner, 2001) which have been found to be associated with mortality in old age (Almeida, Alfonso, Hankey, & Flicker, 2010; Sun, Schooling, Chan, Ho, & Lam, 2010). Greater feelings of usefulness and mastery are associated with lower mortality risk in older adults (Gruenewald, Karlamangla, Greendale, Singer, & Seeman, 2007; Gruenewald, Karlamangla, Greendale, Singer, & Seeman, 2009; Penninx et al., 1997). Self-efficacy may prevent worsening of functional ability (Mendes de Leon, Seeman, Baker, Richardson, & Tinetti, 1996) which in turn is a risk factor for mortality (Miller & Weissert, 2000).

In all, we expected that collective and productive social activities represent different dimensions of social activity, because the resources people give when participating in these activities, their orientation towards them, and the needs met by participation in them differ. We expected that activities such as visiting cultural activities, acting in organizations, dancing, and travelling are usually carried out in a context offering opportunities for socializing, interaction, and sharing experiences. Thus, these activities may be included into collective social activity. We expected that when people help others they give their time, use their capabilities, do good things, and may feel useful and needed. Thus helping others can be included into productive social activity. Furthermore, we expected that collective and productive social activities are associated with mortality risk, but that they may influence health through different pathways.

Many studies among older people have shown that social activity correlates with health outcomes such as survival (e.g. (Brown, Nesse, Vinokur, & Smith, 2003; Sabin, 1993; Seeman, 2000; Walter-Ginzburg, Blumstein, Chetrit, & Modan, 2002)). However, less is known about the factors which underlie the association between social activity and mortality risk. Results of earlier discussed psychosocial factors give some clues, but how about important health-related factors? Based on previous results, we included three mediator candidates of health status in our models: mobility, cognitive functioning, and depressive symptoms. Each factor is tied to everyday life practices, and decline in them threatens independence and presents challenges to the health care system. A mediation model may be used to better understand the association between social activity and mortality.

Results from longitudinal studies show that more frequent participation in social activities decreases the risk for developing mobility disability (Avlund, Vass, & Hendriksen, 2003; Avlund, Lund, Holstein, & Due, 2004; James, Boyle, Buchman, & Bennett, 2011). Mendes de Leon and colleagues (Mendes de Leon, Glass, & Berkman, 2003) found that there was a strong cross-sectional association between social activity and better mobility and that the longitudinal protective effect of social activity diminished slowly over time. Mobility impairments, in turn, predict mortality risk (Guralnik & Ferrucci, 2003; Hirvensalo, Rantanen, & Heikkinen, 2000). Higher levels of social activity also predict better cognitive functioning

(e.g. (Barnes, Mendes de Leon, Wilson, Bienias, & Evans, 2004; Bassuk, Glass, & Berkman, 1999; Beland, Zunzunegui, Alvarado, Otero, & Del Ser, 2005; Krueger et al., 2009; Zunzunegui, Alvarado, Del Ser, & Otero, 2003), although the results have not been consistent across studies (Aartsen, Smits, van Tilburg, Knipscheer, & Deeg, 2002). Social or productive participation may also delay arising depressive symptoms among those not depressed at baseline (Glass, Mendes de Leon, Bassuk, & Berkman, 2006; Wahrendorf, Ribet, Zins, & Siegrist, 2008). Cognitive impairment (Lavery, Dodge, Snitz, & Ganguli, 2009; Sampson, Bulpitt, & Fletcher, 2009; Wilson et al., 2009) and depression (Almeida et al., 2010; Almeida et al., 2010; Sun et al., 2010), in turn, have been found to predict mortality risk in old age. Consequently, it is possible that participation in social activities maintains better mobility and cognitive functions, and prevents increase in depressive symptoms of the participants.

On the other hand, it is possible that better mobility and cognitive functioning and having less depressive symptoms are prerequisites for participating in social activities. In general, the onset of health problems was a major reason for reduction in social participation in old age (Bukov et al., 2002). There is some evidence that cognitive decline may affect the social network. Aartsen and colleagues ((Aartsen, van Tilburg, Smits, & Knipscheer, 2004) found that cognitive decline was associated with loss of relationships, most likely friends and neighbours. Although previous participation in leisure activities predicts late-life participation patterns as people age, impaired mobility and cognition may lead to giving up those activities (Agahi, Ahacic, & Parker, 2006). Resulting from scarcity of the studies concerning different health factors as prerequisites for social activity it is important also to focus on the question whether mobility, cognitive functioning, and depressive symptoms are prerequisites for social activity. This may add the understanding of the factors which need to be taken into account when planning actions to support vulnerable aged people to participate in activities outside home.

The purpose of the present study was to investigate whether mobility, cognitive functioning, and depressive symptoms operate as mediators in the association between social activity and mortality risk, or whether they alternatively should be considered as prerequisites for social activity in 65- to 84-year-old Finnish men and women.

METHODS

Study population and data collection

The data were gathered as part of the Evergreen project, a multidisciplinary, longitudinal research program (Heikkinen, 1998). The study population consisted of people born between 1904 and 1923 who were resident in the city of Jyväskylä, Finland in 1988. Of this group 1 600 persons were randomly sampled for recruitment into the study, with oversampling of those aged 75 years or older at baseline. Of these people, 36 persons had died between the sampling and beginning of the baseline study, 33 had been placed in a nursing home or hospital before the interview and 5 had moved. Of the remaining individuals, 1 224 took part in the baseline interview in 1988. Reasons for non-participation (n=302) included unwillingness to participate in the study (n=158), health problems (n=57), and other reasons (n=60), or the person was not reached (n=27). We excluded from the analyses 21 persons who died during 1988, less than one year from baseline, because closeness of death may have influenced measurements. We also excluded 22 persons who had a large amount of missing data in their baseline questionnaire. Thus our analyses were based on 1 181 individuals, comprising 406 men and 775 women.

Measures

Dates of death obtained from the population register included all the deaths that occurred between January 1988 and December 2009. *Survival time* was calculated as the number of days from January 1st 1988 to either the date of death or the end of the follow-up period (December 14th 2009).

Collective social activity: Participants were asked about their involvement in different kinds of hobbies such as cultural activities (visiting the theatre, going to concerts or movies, etc.), artistic hobbies (playing a musical instrument, singing in a choir, etc.), acting in organizations, congregational activities (activities organized by the church), and studying. The response options were regularly, occasionally, or not at all. For dancing, frequency of participation was categorised as at least once a month, less frequently than once a month, or not at all. For physical activity pursued in groups, frequency of participation was categorised as at least once

a week, less frequently than once or twice a month, or not at all. For domestic and foreign travel, the response options were a few times a year, once a year or less frequently, or not at all. In each variable the most frequent participation was scored 2, the second most frequent participation 1, and the least frequent participation 0.

Productive social activity: The participants were asked about giving help to relatives, friends, or neighbours in cooking, shopping, child caring, cleaning, going for a walk, washing clothes, going to the bank or post office, or in some other way. Frequency of helping in the above-mentioned activities was categorised as “at least once a month”, which scored 2, “less frequently than once a month”, which scored 1, or “not at all”, which scored 0.

Mobility: Participants were asked about ability to walk indoors, outdoors, and climb stairs. The response options were categorized as “yes, without difficulties”, which scored 0, and “has difficulties/not able/needs somebody to help”, which scored 1. A composite score (range 0–3) was calculated for the three mobility dimensions.

Cognitive functioning: To measure cognitive functioning, the Mini-D test was used (Erkinjuntti, Laaksonen, Sulkava, Syrjalainen, & Palo, 1986). The test is based on the theory of Luria, and was originally developed in order to screen for dementia, but it has been used also to assess general cognitive functions in orientation, learning and memory, visualization, reasoning, and problem-solving (Takkinen & Ruoppila, 2001). The test measures orientation in time and place, short and long-term memory, understanding of metaphorical expressions, writing skills, perceiving a figure, and arithmetic skills. The Mini-D test correlates strongly with other cognitive measures such as Digit Span, Digit Symbol, and Word Fluency in aged persons (Ruoppila & Suutama, 1997). We used a summary score of the 35 items of the Mini-D test. A larger score indicates better cognitive functioning, and the scale maximum is 43.

Depressive symptoms: Depressive symptoms were assessed using the Revised Beck’s Depression Inquiry (RBDI) (Raitasalo, 1995) which is a modified version of Beck’s Depression Scale (Beck, Rial, & Rickels, 1974). The RBDI correlates strongly with original Beck’s Depression Scale, both measuring perceived depressive symptoms (Raitasalo, 1995).

In the RBDI, higher scores indicate greater severity of symptoms, and the maximum score is 39.

Covariates included age, full-time education (in years), and morbidity. Morbidity was assessed according to self-reported physician-diagnosed chronic diseases lasting more than 3 months. Diseases were subsequently classified by a physician according to the ICD-9. We included in the analyses serious diseases (ischemic heart disease, cardiac insufficiency, heart infarction, cerebral infarction, and chronic obstructive pulmonary disease) and other less serious diseases which are, however, likely to restrict social participation (e.g. diabetes, other cardiovascular diseases, epilepsy, Parkinson's disease, paralysis, muscular skeletal diseases, and mental disorders). The number of all chronic diseases was used in the analyses.

Statistical analysis

Analyses were conducted in four steps. First, we validated the two-factor structure of the social activity data by using exploratory factor analysis. Second, we used the confirmatory factor analysis to assess the paired associations of the social activity factors (latent variables) on mobility, cognitive functioning, and depressive symptoms. Third, we then tested the effects of mobility, cognitive functioning, depressive symptoms, and social activity on mortality risk using proportional hazards models adapted for factor variables. Fourth, the proportional hazards models were extended to mediator models to investigate pathways between the (collective and productive) social activity factors and mortality risk with mobility, cognitive functioning, and depressive symptoms as possible mediators in our main hypothesized model, and in competing models, including one with mobility, cognitive functioning, and depressive symptoms as prerequisites for the social activity dimensions. Since the models were non-nested, we compared them using three standard information criteria: Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample-size adjusted BIC (aBIC). We also used the AIC-based evidence ratio (Burnham & Anderson, 2004) to assess the probability of information loss related to using a less well fitting model on data. In the latent variable models mortality risk was adjusted for age, education, and chronic diseases. The likelihood ratio test in two-group analyses for men and women showed that both the factor structure ($p < 0.001$) and the mediating effects ($p < 0.001$) differed between the sexes. Thus,

we constructed completely separate models for men and women. The analyses were performed with MPLUS version 5.21 (Muthén & Muthén, 1998-2009). The Multiple Imputation (MI) procedure of SAS for Windows, version 9.1, was used to impute missing values using the available information from the model variables and also additional variables on various background characteristics, physical activity, functional ability, perceived memory, and mental alertness.

RESULTS

The percentages of participation in social activities and the factor loadings and coefficients of determination for collective and productive social activity are shown in Table 1 for men and women separately. Overall, 80 per cent of men and 76 per cent of women had at least one regular social activity, and 26 per cent of men and 27 per cent of women helped others in one or more tasks at least once a month. Among both men and women, cultural activities, artistic hobbies, organizational participation, studying, travelling, dancing, and physical activity pursued in groups formed a latent variable describing collective social activity. Helping others in cooking, shopping, child care, cleaning, going for a walk, washing clothes, going to the bank or post office, and helping in some other way formed a latent variable describing productive social activity. The bivariate correlation between the social activity factors was moderate. In further latent variable models, we specified the same measurement model for the two factors. We do not report the factor structure and significance of factor loadings of further models, as they remained similar in these analyses.

[Table 1]

No mobility problems were reported by 69 per cent of men and 56 per cent of women, while difficulties in two or three mobility dimensions were reported by 17 per cent of men and 24 per cent of women. The mean (standard deviation) in the Mini-D test was 36.4 (5.4) for men and 36.2 (5.3) for women. The mean in the Revised Beck's Depression Inquiry was 2.7 (3.02) for men and 3.6 (3.4) for women. On average men had 1.06 (0.98) chronic diseases and women 1.16 (1.05).

Among men, 89 per cent had died during 21-year follow-up, yielding a mortality rate of 7.9 deaths per 100 person-years. Collective social activity correlated with mortality and with mobility, cognitive functioning, and depressive symptoms all of which, in turn, also correlated with mortality (Table 2). Productive social activity also correlated with mortality, mobility, and cognitive functioning, but not with depressive symptoms. In the full path model, controlled for age, education, and number of chronic diseases, mobility and cognitive functioning mediated the effect of collective and productive social activity on mortality risk (Figure 1). There was also a statistically significant direct effect of collective social activity on mortality risk. No mediating effect was observed for depressive symptoms.

[Table 2]

[Figure 1]

Among women, 81 per cent had died during the follow-up, yielding a mortality rate of 6.4 deaths per 100 person-years. The results of the preliminary analyses for women were comparable to the results obtained for men except that productive social activity was also correlated with depressive symptoms, but not with cognitive functioning (Table 2). The results of the full pathway model for women were comparable to the results for men except that no mediating effect was observed for cognitive functioning (Figure 2).

[Figure 2]

Comparing the information criteria showed that the competing models fitted better to the data than the mediating model (Model 1) (Table 3). The likelihood that any one of the models other than model 8 would minimize information loss more efficiently was less than 0.001, indicating that model 8 was clearly the best fitting model to the data. This was case in both men and women.

[Table 3]

In the competing model among men, results showed that good cognitive functioning was a prerequisite for collective and productive social activities (Figure 3). Having less depressive symptoms was a prerequisite for participating in collective social activities. Mobility functioned as a mediator between social activity factors and mortality risk. Among women, the results were comparable to those obtained for men except that having less depressive symptoms was a prerequisite also for productive social activity (Figure 4). Among both sexes, there remained an independent effect of collective social activity on mortality risk.

[Figure 3]

[Figure 4]

DISCUSSION

The aim of this study was to investigate whether mobility, cognitive functioning, and depressive symptoms mediate the association between social activity and mortality risk, or whether they alternatively should be considered as prerequisites for social activity in older Finnish men and women. Results showed that, among both men and women, mobility mediated part of the association between collective social activity and mortality risk. Instead, good cognitive functioning and having less depressive symptoms can be better seen as prerequisites for participating in collective social activity among older men and women. Among men, good cognitive functioning, and among women, good cognitive functioning and having less depressive symptoms were prerequisites for productive social activity.

One of our main findings was that mobility mediated part of the association between social activity and mortality. Mobility is a good health indicator because decline in mobility captures the overall impact of chronic conditions (Guralnik et al., 1993), the effect of physiological changes (Guralnik, Ferrucci, Simonsick, Salive, & Wallace, 1995; Rantanen et al., 2001), and lifestyle activities (Avlund et al., 2003; Fujita, Fujiwara, Chaves, Motohashi, & Shinkai, 2006). Earlier, Buchman and colleagues (Buchman et al., 2009) found that decrease in social activity was associated with a more rapid rate of decline in motor function, which in turn was associated with increased mortality risk. First of all, most of the activities studied here also

include physical activity, which has potential for maintaining mobility. Second, social interaction may encourage a more active lifestyle, thereby helping to maintain better mobility. Our data, as well as earlier theoretical background (Agahi et al., 2006), showed that mobility can also be seen as a prerequisite for participating in various out-of-home activities. However, a model showing that mobility mediated part of the association between social activity and mortality risk was clearly the best fitting model to the data.

Another main finding was that better cognitive functioning was a prerequisite enabling older persons to participate more actively in social activities (see Aartsen et al. 2002, (Agahi et al., 2006). It is possible that withdrawing from participation in social activities outside the home may be among the first signs of worsening cognitive functioning. Another potential explanation has to do with the role of cognitive functioning for transportation to social activities. In Finland people aged 70 years need to have a doctor's assessment of their competency to drive a car. If cognitive functioning has worsened and a serious memory disorder is apparent, the driving license may be revoked. However, according to the "use it or lose it" hypothesis of cognitive aging, social activity offers protective benefits from age-related cognitive decline (Bielak, 2010). Thus, it may also be possible that participation in various hobbies may include cognitive stimulation and help to maintain better health, although our data did not support this perspective.

Based on the earlier literature we hypothesized that social participation may prevent increasing depressive symptoms which in turn may be associated with decreased mortality risk. Although a representative, random sample was drawn, it is probable that those with depressive symptoms did not participate in the study, thus reducing the observed variance in the Revised Beck's Depression Inquiry. Another reason why depressive symptoms were not associated with mortality risk in the final model may be that depressive symptoms have shared underlying causes (shared variance, see e.g. Shapiro et al. 1999) with mobility and cognitive functioning among men, and with mobility among women. Mobility and cognitive functioning were stronger risk factors for mortality than depressive symptoms in both sexes, which reduced the coefficient for depressive symptoms. It is also possible that residual correlation from important omitted effects influenced the estimates of the predictor-mediator-outcome

pathway, although we were unable to specify or adjust for effects of this kind. Instead, the results showed that depressive symptoms were a prerequisite for more active participation in collective social activities. Among women, having less depressive symptoms was a prerequisite also for productive social activity. It is conceivable that those having a lot of depressive symptoms are not inclined to participate in various social activities outside home, and they may need extra support to find activities they like, to motivate them and provide them with a company for participating.

The direct effect of collective social activity on mortality risk observed even after adding mobility, cognitive functioning, and depressive symptoms into the models suggests that other mechanisms not studied here may explain the association. Social participation may be associated with better quality of life, happiness, and experiencing life as worth living (Golden, Conroy, & Lawlor, 2009). Feelings of purpose in life have been found to be related to decreased mortality risk in older people (Boyle, Barnes, Buchman, & Bennett, 2009). Older people, whose subjective wellbeing is good, may have also better coping strategies (Segerstrom, Taylor, Kemeny, & Fahey, 1998). Receiving social support from social relationships may help to buffer stress in times of crisis (Uchino, 2004). Multiple social roles or giving social support to other people are also associated with feelings of personal control and sense of self-efficacy (Adelmann, 1994; Krause, Herzog, & Baker, 1992). Self-efficacy has been found to be related to better self-rated health (Parkatti, Deeg, Bosscher, & Launer, 1998), which in turn is associated with decreased mortality risk (Ford, Spallek, & Dobson, 2008; Idler & Benyamini, 1997; Lyyra, Leskinen, Jylha, & Heikkinen, 2009).

The strengths of this study were a representative population-based sample of older people living in the community, data collection through face-to-face interviews, a high response rate (80 %), and a long follow-up time for mortality. Furthermore, in Finland, register-based data on mortality is reliable and coverage is complete. A potential limitation of this study was that other meaningful social activities may exist that were not captured in our interview, such as informal social gatherings and volunteering. Another potential limitation is that some of the study items collected in the 1980s at the baseline of the study may not be consistent with present-day knowledge of the topic. We were not always able to know whether some activities

categorized as collective were not in fact done alone. However, we are fairly sure that activities such as singing, painting, or studying are carried out in a social context in our data. Community music and art classes are highly developed in the area of residence of our sample, and for example the University of the Third Age has been an important venue for education older people. Not including these activities would have led to underestimation of participation in collective social activities. One limitation is the cross-sectional study frame for the explanatory variables. However, we have studied both mediation and competing models, and determined the best fitting model to the data.

Conclusion: Social activity decreases mortality risk among older men and women. The association may partly be explained by better mobility. Good cognitive functioning and having less depressive symptoms may be prerequisites for participating in social activities. However, more research on the direction of the association between cognitive functioning, depressive symptoms, and social activity is needed in order to achieve a deeper understanding of this association.

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Author contributions

K. Pynnönen: Conception and design, drafting the manuscript, acquiring the funding for conducting the research. T. Törmäkangas: Contribution to the design of the study, data analysis, critical revision for important intellectual content. T. Rantanen: Critical revision for important intellectual content. T-M. Lyyra: Contribution to the design of the study, critical revision for important intellectual content.

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Table 1. Proportion of participation in social activities, standardized factor loadings for confirmatory factor analysis, 95 % confidence intervals and coefficient of determination (R^2) for social activity factors, and factor correlations among men (n=406) and women (n=775).

	Men					Women				
	Participation,%		Factor	95% CI	R^2	Participation, %		Factor	95% CI	R^2
Reg. ¹	Occas. ²	loadings	Reg. ¹			Occas. ²	loadings			
Collective social activity										
Receptive cultural activities	9	46	0.759	0.66, 0.86	0.58	11	49	0.697	0.62, 0.77	0.49
Studying	7	3	0.669	0.51, 0.83	0.45	4	3	0.526	0.38, 0.67	0.28
Travelling in home country	70	18	0.665	0.54, 0.79	0.44	64	21	0.683	0.60, 0.77	0.47
Travelling abroad	14	39	0.537	0.41, 0.66	0.29	12	36	0.654	0.58, 0.73	0.43
Organizational participation	27	15	0.535	0.41, 0.66	0.29	24	10	0.596	0.51, 0.68	0.36
Dancing	8	16	0.553	0.43, 0.68	0.31	4	7	0.690	0.58, 0.80	0.48
Artistic hobbies	13	9	0.440	0.27, 0.61	0.19	10	6	0.459	0.35, 0.57	0.21
Physical activity pursued in groups	7	3	0.281	0.08, 0.48	0.08	10	2	0.420	0.28, 0.56	0.18
Congregational activities	7	9	0.137	-0.03, 0.31	0.02	20	13	0.061	-0.03, 0.15	0.00
Productive social activity										
Helping in shopping	13	7	0.906	0.84, 0.97	0.82	9	7	0.825	0.71, 0.94	0.68
Helping in washing clothes	3	3	0.885	0.80, 0.97	0.78	5	3	0.880	0.77, 1.00	0.77
Helping in going to the bank or post office	8	7	0.852	0.78, 0.93	0.73	4	5	0.763	0.64, 0.89	0.58
Helping in cleaning	11	6	0.848	0.76, 0.93	0.72	6	2	0.907	0.80, 1.02	0.82
Helping in cooking	7	4	0.821	0.72, 0.92	0.67	9	5	0.745	0.63, 0.86	0.55
Helping in going for a walk	2	2	0.556	0.32, 0.79	0.31	6	4	0.570	0.44, 0.70	0.33
Helping in child caring	7	7	0.394	0.23, 0.56	0.16	8	9	0.308	0.18, 0.44	0.10
Helping in some other way	3	11	0.352	0.20, 0.51	0.12	3	8	0.251	0.11, 0.40	0.06
Correlation between factors			0.345	0.20, 0.49				0.270	0.15, 0.40	

¹: Regularly in receptive cultural activities, studying, organizational participation, artistic hobbies, and congregational activities; at least few times a year in travelling in home country and abroad; at least once a month in dancing; at least once a week in physical activities pursued in groups; and at least once a month in helping tasks.

²: Occasionally in receptive cultural activities, studying, organizational participation, artistic hobbies, and congregational activities; once a year or less frequently in travelling in home country and abroad; less frequently than once a month in dancing; less frequently than once or twice a week in physical activities pursued in groups; and less frequently than once a month in helping tasks.

Table 2. Unstandardized bivariate path coefficients (Est.) and 95 % confidence intervals (CI) between social activity factors, mortality, mobility, cognitive functioning and depressive symptoms among men (n=406) and women (n=775).

	Mortality		Mobility		Cognitive functioning		Depressive symptoms		Collective social activity		Productive social activity	
	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI
Men												
CSA	-0.49	-0.78, -0.21	-0.79	-1.32, -0.26	2.46	0.97, 3.95	-1.67	-2.67, -0.66	-	-	-	-
PSA	-0.06	-0.13, -0.00	-0.27	-0.45, -0.09	0.46	0.09, 0.83	-0.00	-0.20, 0.19	-	-	-	-
Mobility	0.43	0.32, 0.53	-	-	-	-	-	-	-0.38	-0.59, -0.17	-1.12	-1.68, -0.55
Cognit func	-0.07	-0.09, -0.04	-	-	-	-	-	-	0.08	0.04, 0.12	0.16	0.08, 0.25
Depr sympt	0.08	0.05, 0.11	-	-	-	-	-	-	-0.11	-0.18, -0.05	-0.12	-0.23, -0.01
Women												
CSA	-0.38	-0.57, -0.20	-1.03	-1.49, -0.56	2.80	1.90, 3.70	-1.17	-1.71, -0.63	-	-	-	-
PSA	-0.10	-0.17, -0.02	-0.37	-0.58, -0.16	0.16	-0.11, 0.43	-0.35	-0.58, -0.11	-	-	-	-
Mobility	0.40	0.31, 0.48	-	-	-	-	-	-	-0.41	-0.55, -0.27	-0.72	-1.00, -0.44
Cognit func	-0.06	-0.08, -0.04	-	-	-	-	-	-	0.10	0.07, 0.14	0.08	0.11, 0.58
Depr sympt	0.05	0.02, 0.07	-	-	-	-	-	-	-0.09	-0.13, -0.05	-0.15	-0.23, -0.08

Note: CSA = collective social activity, PSA = productive social activity.

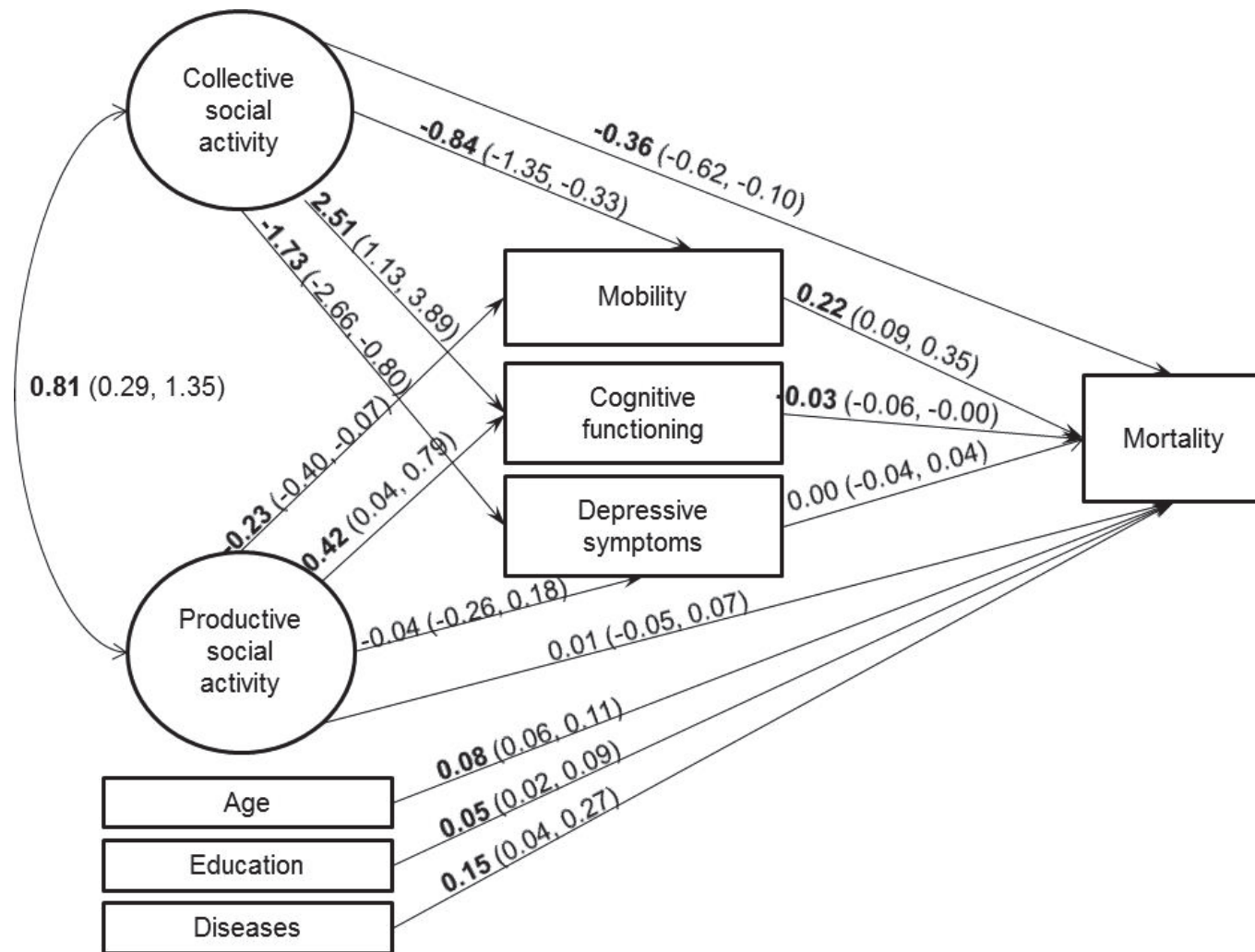


Figure 1. Unstandardized path coefficients (95 % confidence intervals) of latent factor mediator model for social activity factors, mobility, cognitive functioning, depressive symptoms, and mortality risk among men (n=406).

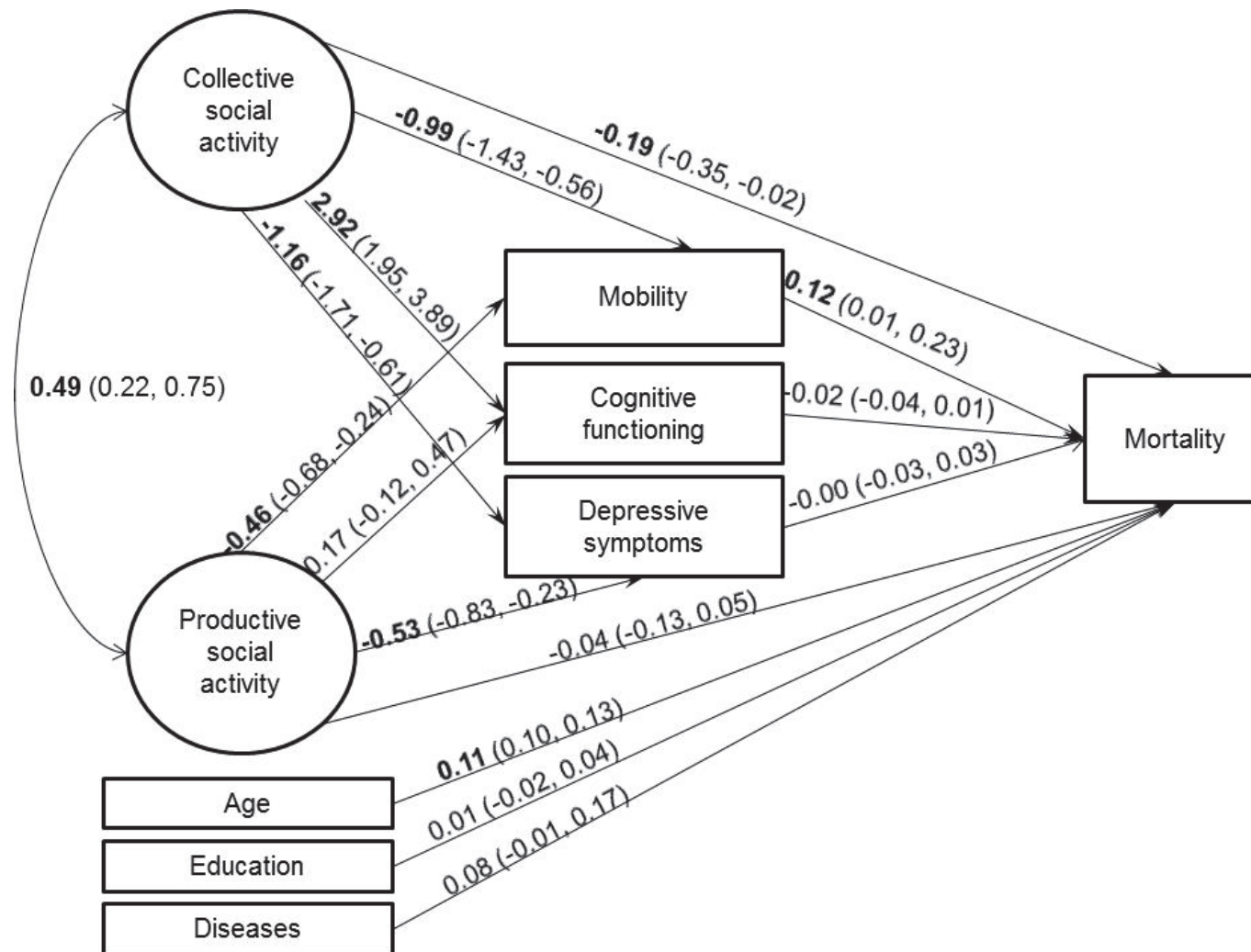


Figure 2. Unstandardized path coefficients (95 % confidence intervals) of latent factor mediator model for social activity factors, mobility, cognitive functioning, depressive symptoms, and mortality risk among women (n=775).

Table 3. Number of free parameters (*df*), scaling parameters of the robust maximum likelihood estimation method, information criteria (Akaike information criterion, AIC, Bayesian information criterion, BIC, and sample-size adjusted BIC, aBIC) of non-nested mediator models among men (n=406) and women (n=775).

	Model	Direction of causation			df	AIC	BIC	aBIC
Men	1	(C,P) → Mob	(C,P) → DepS	(C,P) → Cog	73	18872	19165	18933
	2	Mob → (C,P)	(C,P) → DepS	(C,P) → Cog	73	18867	19159	18928
	3	Mob → (C,P)	DepS → (C,P)	(C,P) → Cog	71	16834	17118	16893
	4	(C,P) → Mob	(C,P) → DepS	Cog → (C,P)	71	16834	17118	16892
	5	(C,P) → Mob	DepS → (C,P)	(C,P) → Cog	71	16815	17100	16874
	6	Mob → (C,P)	(C,P) → DepS	Cog → (C,P)	71	16351	16636	16411
	7	Mob → (C,P)	DepS → (C,P)	Cog → (C,P)	69	14337	14613	14394
	8	(C,P) → Mob	DepS → (C,P)	Cog → (C,P)	69	14313	14590	14371
Women	1	(C,P) → Mob	(C,P) → DepS	(C,P) → Cog	73	35262	35602	35370
	2	Mob → (C,P)	(C,P) → DepS	(C,P) → Cog	73	35245	35585	35353
	3	Mob → (C,P)	DepS → (C,P)	(C,P) → Cog	71	31232	31563	31337
	4	(C,P) → Mob	(C,P) → DepS	Cog → (C,P)	71	31232	31563	31337
	5	(C,P) → Mob	DepS → (C,P)	(C,P) → Cog	71	31164	31494	31269
	6	Mob → (C,P)	(C,P) → DepS	Cog → (C,P)	71	30530	30860	30635
	7	Mob → (C,P)	DepS → (C,P)	Cog → (C,P)	69	26521	26842	26623
	8	(C,P) → Mob	DepS → (C,P)	Cog → (C,P)	69	26404	26726	26506

Note. Mortality was the dependent variable in the models. Mortality risk was adjusted for age, education, and number of chronic diseases.

Note. Arrows point the direction between variables in the path models.

Note. (C,P) = Separate collective and productive social factors, Mob = mobility, DepS = Revised Beck's Depression Inquiry score, Cog = MiniD-test score.

Note. AIC: Akaike information criterion, BIC: Bayesian information criterion; aBIC: sample-size adjusted BIC, where $n^* = (n + 2) / 24$, *df*: number of free parameters in the model.

Note. In all models the probability that the worse fitting models minimize information loss was less than 0.001.

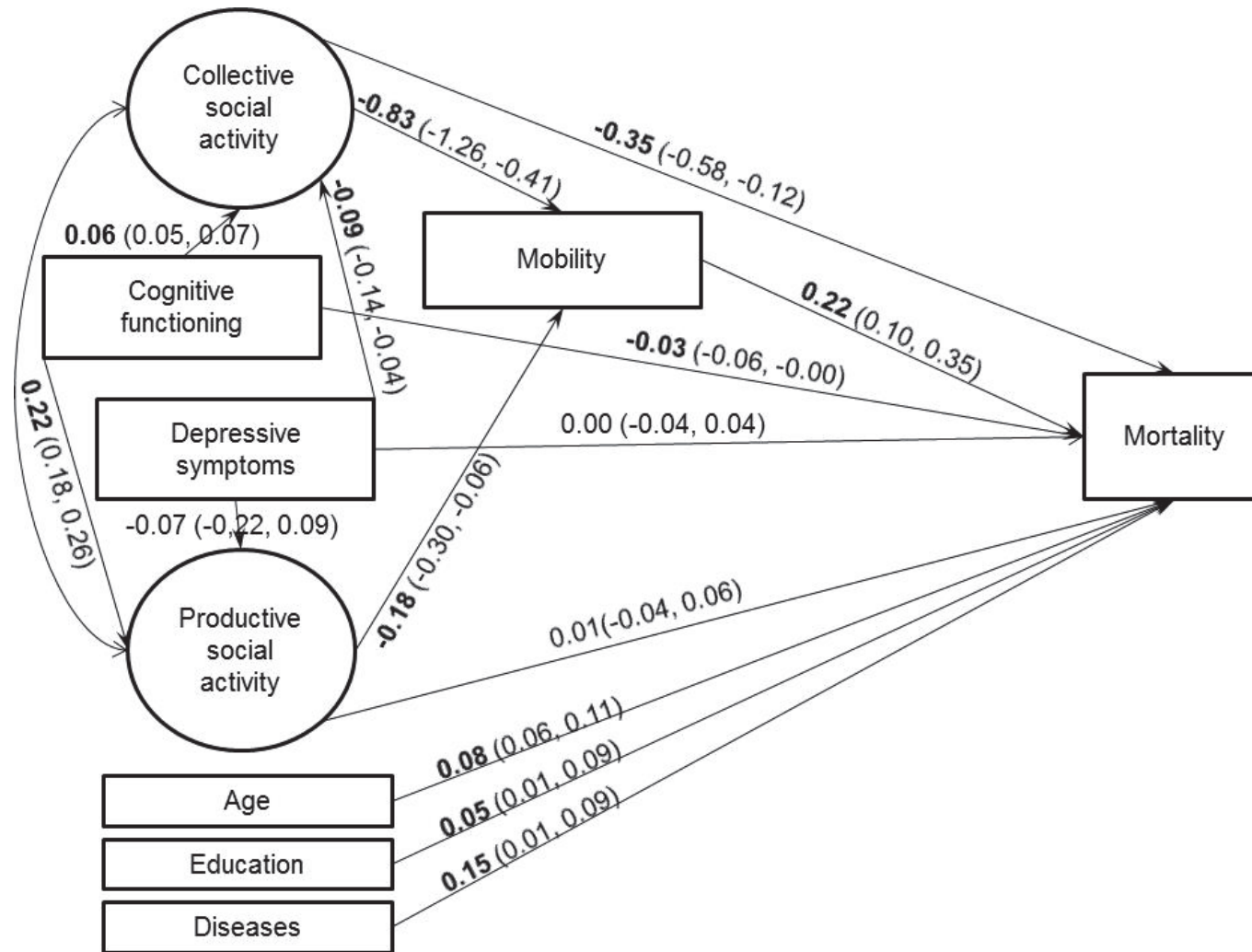


Figure 3. Unstandardized path coefficients (95 % confidence intervals) of latent factor resource model for cognitive functioning, depressive symptoms, social activity factors, mobility, and mortality risk among men (n=406).

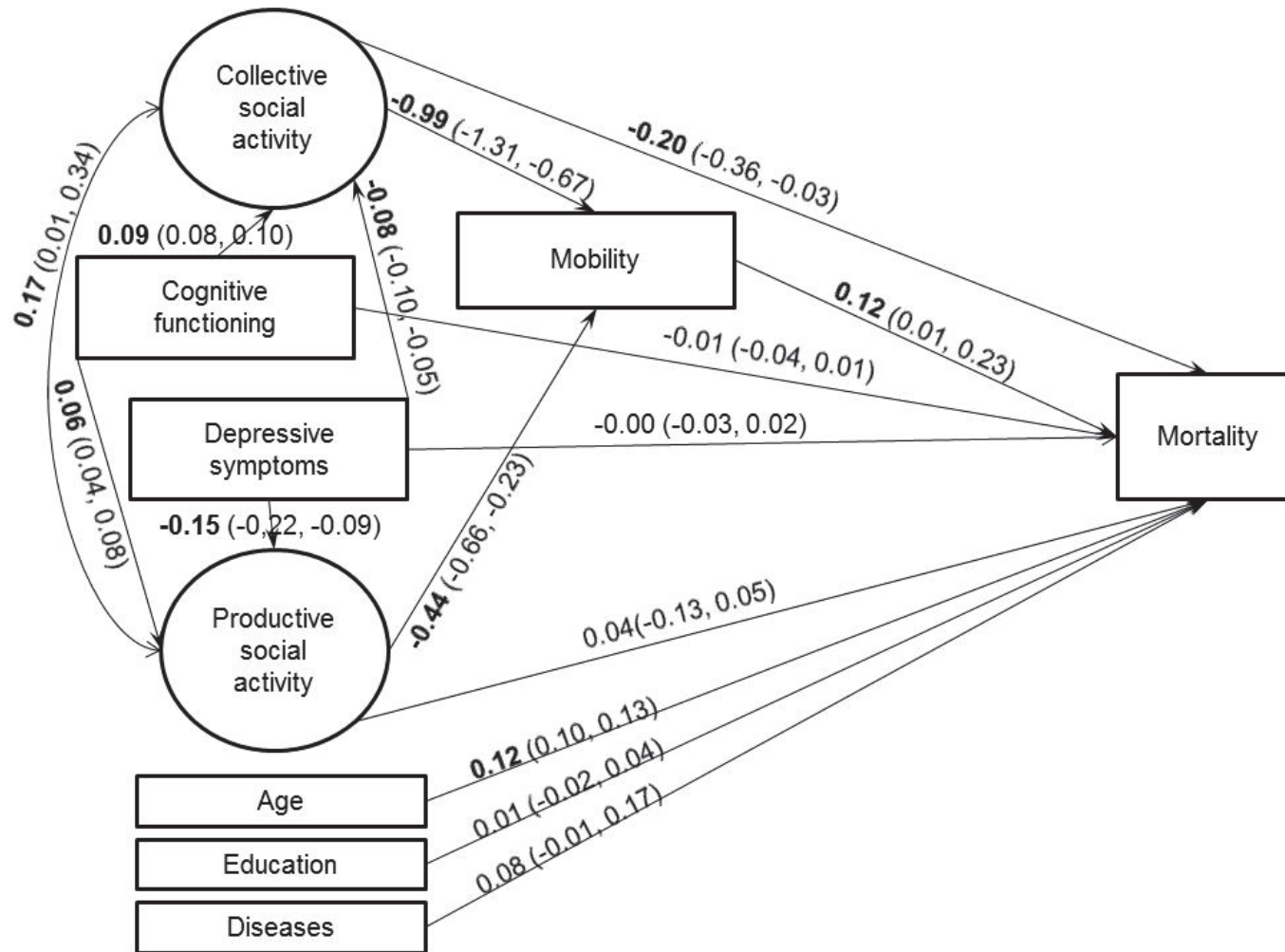


Figure 4. Unstandardized path coefficients (95 % confidence intervals) of latent factor resource model for cognitive functioning, depressive symptoms, social activity factors, mobility, and mortality risk among women (n=775).

III

ASSOCIATIONS BETWEEN THE DIMENSIONS OF PER- CEIVED TOGETHERNESS, LONELINESS, AND DEPRESSIVE SYMPTOMS AMONG OLDER FINNISH PEOPLE

by

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**Associations between the Dimensions of Perceived Togetherness,
Loneliness, and Depressive Symptoms among Older Finnish People**

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Associations between the Dimensions of Perceived Togetherness, Loneliness, and Depressive Symptoms among Older Finnish People

Abstract

Objectives: We studied the associations between perceived togetherness, depressive symptoms, and loneliness over a six-month period among 222 people aged 75-79 who reported loneliness or depressive mood at baseline.

Method: The present cross-lagged models utilized baseline and six-month follow-up data of a randomized controlled trial that examined the effects of a social intervention on loneliness and depression (ISRCTN78426775). Dimensions of perceived togetherness, i.e., attachment, social integration, guidance, alliance, nurturance, and reassurance of worth, were measured with the Social Provisions Scale, depressive symptoms with a short form of the Geriatric Depression Scale, and loneliness with a single item.

Results: After controlling for baseline loneliness and depressive symptoms, baseline higher attachment in all participants and baseline higher opportunity for nurturance in the social intervention group predicted lower depressive mood at follow-up. No cross-lagged associations between the dimensions of perceived togetherness at baseline and loneliness at follow-up were observed. In addition, depressive symptoms and loneliness at baseline tended to negatively predict the dimensions of perceived togetherness at follow-up.

Discussion: Depressive symptoms and loneliness appear to be precursor for perceived togetherness, rather than dimensions of perceived togetherness to be antecedents of loneliness and depressiveness among older people.

Keywords: Cross-lagged modeling, mental health, social need, social provision

Introduction

People have a fundamental need and motivation to form frequent, affectively pleasing, and relatively enduring relationships with at least a few other people (Baumeister & Leary, 1995). In his social provision theory, Robert Weiss (1974) proposed that people need various kinds of social relationships to fulfill their various social needs. Weiss (1974) identified six dimensions that describe the social needs of people; these he termed social provisions. They were named: *attachment*, *social integration*, *guidance*, *sense of reliable alliance*, *opportunity for nurturance*, and *reassurance of worth*. *Attachment* stems from the feeling of safety and security, most often experienced in spousal relationships or relationships with close friends. *Social integration* refers to the sense of belonging to a group, for example, one feels that there are people around one who appreciate the same things, or have the same concerns. *Reliable alliance* refers to relationships in which the person can count on assistance under any circumstances. *Guidance* is available in relationships with trustworthy and authoritative individuals who can provide advice and assistance. *Opportunity for nurturance* refers to feelings of being responsible for the well-being of another, typically most often present in spousal relationships and relationships with children. *Reassurance of worth* refers to the feeling that the person's skills and abilities are acknowledged. We use the term *perceived togetherness* to refer to the six dimensions of social provisions described above (Tiikkainen, Heikkinen, & Leskinen, 2004) as it illustrates a positive angle on social relations better than the term social provisions. To summarize, perceived togetherness refers to the way people feel their existing social relations meet their needs and expectations.

The theoretical model of social provisions proposed by Weiss (1974) was subsequently operationalized by Cutrona and Russell (1987), who developed the Social Provisions Scale. Respondents are asked to rate the degree to which their social relationships currently supply attachment, social integration, guidance, sense of reliable alliance, opportunity for nurturance,

and reassurance of worth. For the internal consistency of the whole scale, Cutrona, Russell, and Rose (1986) reported values ranging from .85 to .92 in different populations and the value of .92 in a sample of older adults. In a study of Finnish 80-year-olds, Cronbach's alpha for the whole scale was .86, with alphas for the individual dimensions ranging from .53 (social integration) to .66 (reliable alliance) (Tiikkainen & Heikkinen, 2005).

Theoretically, feelings of loneliness may result from a deficit in one or more dimensions of perceived togetherness (see Weiss, 1973). Loneliness can be viewed as the outcome of discrepancy between a person's social needs and the degree to which those needs are satisfied (Rokach, 2011; Russell, Cutrona, Rose, & Yurko, 1984; Weiss, 1973). From the point of view of well-being, satisfaction with the social relationships a person has is more central than the actual size and composition of their network (Antonucci, Fuhrer, & Dartigues, 1997; Fuller-Iglesias, 2015), although these two factors have been found to correlate, particularly among men (Pulkkinen, Lyyra, & Kokko, 2011).

Empirical studies have shown that the Social Provisions Scale can be used in studies among diverse populations (see Cutrona & Russell, 1987), and that scores on it correlate negatively with measures of loneliness (Russell et al., 1984). Among community-dwelling 80-year-old persons, lack of attachment, social integration, and reliable alliance were associated with feelings of loneliness (Tiikkainen & Heikkinen, 2005). Among nursing home residents without cognitive impairment, lower attachment was associated with more feelings of loneliness, whereas social integration, nurturance, and reassurance of worth were not associated with feelings of loneliness (Drageset, Espehaug, & Kirkevold, 2012). Among college students, lower attachment, social integration, and reassurance of worth were related to the presence of loneliness (Kraus, Davis, Bazzini, Church, & Kirchman, 1993). These studies showing that low scores in dimensions of perceived togetherness co-exist with loneliness have all been cross-sectional; thus, whether the dimensions of perceived

togetherness are antecedents of loneliness has not been ascertained. Clearly, longitudinal studies on the association between perceived togetherness and loneliness are needed.

In older people, loneliness and depressive symptoms often co-occur (Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006). However, as depressiveness may stem not only from changes in social relationships but also from other non-social factors, it can be regarded as a broader phenomenon than loneliness. Older people who are lonely will often present with depressive symptoms but depressed individuals do not always report loneliness (Luanaigh & Lawlor, 2008). Some studies have shown that loneliness is a potential risk factor for depressiveness (Bergdahl, Allard, Alex, Lundman, & Gustafson, 2007; Heikkinen & Kauppinen, 2004; Kaneko, Motohashi, Sasaki, & Yamaji, 2007; Luanaigh & Lawlor, 2008); however, depressive symptoms may also increase the risk for loneliness (Routasalo, Savikko, Tilvis, Strandberg, & Pitkälä, 2006; Savikko, Routasalo, Tilvis, Strandberg, & Pitkala, 2005; Tiikkainen & Heikkinen, 2005). It is likely that loneliness and depression are related but distinct states (Luanaigh & Lawlor, 2008). Thus, before planning interventions to alleviate loneliness and to reduce depressive symptoms among older people, it would be important to find out whether depressive symptoms precede loneliness or vice versa. Of the dimensions of perceived togetherness, low scores for guidance, reliable alliance, reassurance of worth, and attachment have been found to explain higher depressive symptoms (Tiikkainen & Heikkinen, 2005), while higher attachment and reassurance of worth were associated with better emotional well-being (Stephens, Alpass, Towers, & Stevenson, 2011). In longitudinal studies among older people, a higher level of reliable alliance and reassurance of worth predicted a lower level of depressive symptoms (Russell & Cutrona, 1991). Cutrona and colleagues (1986) showed that higher levels of guidance and reliable alliance were related to subsequent positive mental health in conditions where older persons experienced many negative life events.

The relative importance of social needs may vary from person to person depending, for example, on age and life situation (Weiss, 1973). However, the theory does not adequately explain how the relative importance or experiences of the different dimensions of perceived togetherness change at different stages of life (Mancini & Blieszner, 1992). It is unclear whether all or only some of the dimensions of perceived togetherness are associated with both loneliness and depressive symptoms among older people.

This article reports an exploratory observational analysis of data collected as part of a randomized controlled trial that targeted community-dwelling older people who reported negative mood or loneliness at study entry (GoodMood; ISRCTN78426775) (Pynnonen, Tormakangas, Rantanen, Tiikkainen, & Kallinen, 2016). The objective of the study was to investigate longitudinal associations of the six dimensions of perceived togetherness with depressive symptoms and feelings of loneliness. We used cross-lagged analyses, as these enable study of whether the dimensions of perceived togetherness at baseline are associated with loneliness or depressive symptoms at follow-up after controlling for loneliness and depressive symptoms at baseline (Figure 1). Based on the theoretical standpoints discussed above, we hypothesized that deficits in the dimensions of perceived togetherness at baseline would longitudinally explain experiences of loneliness and depressive symptoms at follow-up.

[Figure 1 near here]

Methods

Study Population and Data Collection

The GoodMood project aimed to assess the effects of a six-month social intervention of choice (supervised exercise, social activity, or personal counseling) vs. self-directed group on loneliness and mood. Participants were 75- to 79-year-old persons living in the central area of

the city of Jyväskylä, Central Finland. Contact information was gathered from the Finnish population register and the suitability and interest of potential participants was assessed over the phone following a mailed information letter. Between September and November 2008, 223 persons took part in a structured face-to-face home interview and in one meeting with a counselor. All participants (a) had reported feelings loneliness, melancholy, or depressive mood at least sometimes, (b) scored higher than 21 in the Mini-Mental State Examination, and (c) gave their informed consent to participate in the study. Randomized social intervention (n=105) and self-directed (n=118) groups were formed. After the 6-month intervention, between April and June, 2009, a follow-up face-to-face interview was conducted in the participants' homes. In the follow-up interview, one participant was excluded, as the interviewer reported that the replies given were not valid. Thus, for the present exploratory analyses the *social intervention group* comprised 104 and the *self-directed group* 118 participants. The sampling procedure and study design have been described in more detail elsewhere (Pynnonen et al., 2016).

Social Intervention of Choice vs. Self-directed Control

The social intervention group members were allowed to select the intervention regime they thought would benefit them the most: supervised exercise in a group (selected by 44 participants), personal counseling (selected by 33 participants), and a social activity program (selected by 27 participants). Each regime included social interaction and participants were able to influence the content of the meetings. The exercise and social activity programs were held once a week and 19–21 times in total during the intervention. The personal counseling meetings were held approximately every third week and each participant attended 4–5 meetings. The self-directed group received one counseling session, which included discussion of the participant's life situation and available social support and the services offered by the

municipality and other service providers. The social intervention group received more social attention and activity than the self-directed group.

Measurements

Depressive symptoms were measured using a short form of the Geriatric Depression Scale (GDS-15). The GDS is specially designed to screen for depressed mood in older adults (see Greenberg, 2007). A larger score indicates greater severity of symptoms and the scale maximum is 15. We used the sum score in the analyses. Experience of *loneliness* was assessed with the question: “Do you feel lonely?” The response options were “very rarely or never”, “sometimes”, and “often or almost always”.

Dimensions of perceived togetherness were measured using the Social Provisions Scale developed on the basis of Weiss’ theory (Cutrona & Russell, 1987). Its 24 items are equally divided between the six different dimensions: attachment, social integration, guidance, reliable alliance, opportunity for nurturance, and reassurance of worth. Two of the four questions in each dimension are positively and two negatively worded. On a scale from “strongly disagree” (scored 1) to “strongly agree” (scored 4), the respondents were asked to assess to what extent they thought each statement described their current social relationships. Example items are *attachment*: “I do not have a feeling of closeness with anyone”; *social integration*: “there are people who like the same social activities I do”; *guidance*: “there is no one I feel comfortable talking about problems with”; *reliable alliance*: “there are people I know will help me if I really need it”; *opportunity for nurturance*: “I feel responsible for taking care of someone else”; and *reassurance of worth*: “there are people who value my skills and abilities”. The responses to the negatively worded items were reversed. A sum score was calculated for each dimension with scores ranging between 4 and 16, where larger values indicate a more positive situation.

Information on age (in years), gender, living alone (no/yes), co-morbidity, cognitive functioning, and mobility were gathered during the face-to-face interviews. The models were adjusted for living alone and difficulties in mobility. Living alone is associated with loneliness (Routasalo et al., 2006; Russell, 2009); it also reflects marital status and tells about the loss or absence of everyday companionship. In addition, a spouse usually provides a close and intimate tie among older people. Mobility is a good health indicator, as mobility decline captures the overall impact of chronic conditions (Guralnik et al., 1993), the effect of physiological changes (Guralnik, Ferrucci, Simonsick, Salive, & Wallace, 1995; Rantanen et al., 2001), and lifestyle activities (Avlund, Vass, & Hendriksen, 2003; Fujita, Fujiwara, Chaves, Motohashi, & Shinkai, 2006). Mobility was assessed by asking about perceived difficulties in walking 2 km, 500 m, ambulating indoors, and climbing stairs. The response options for these were “not able” (scored 0), “not able without somebody to help” (scored 1), “yes, but has difficulties” (scored 2), or “yes, without difficulties” (scored 3). The measure of mobility was computed as the sum of the four perceived difficulty items. Co-morbidity was assessed by asking the participant to state all physician-diagnosed chronic diseases of longer than three months’ duration. Cognitive functioning was assessed with the Mini-Mental State Examination, MMSE (Folstein, Folstein, & McHugh, 1975).

Statistical Analysis

Cross-lagged modeling was used to estimate associations between the studied variables (Figure 1). Weighted least square estimator (WLSMV) was used to obtain parameter estimates. The dimension of perceived togetherness, loneliness, and depressive symptoms at baseline were adjusted for baseline status of living alone (with somebody vs. alone) and baseline perceived difficulties in mobility. In the follow-up situation, the studied variables were adjusted for baseline living situation and follow-up perceived difficulties in mobility. When the direction was set from depressive symptoms to loneliness, the estimates of the root

mean square error of approximation (RMSEA), a measure of model fit, were smaller than when the direction was set in the opposite direction. Thus, models with the direction from depressive symptom to loneliness fitted the data better than those with the direction from loneliness to depressive symptoms. For the GDS-15, Cronbach's alphas were 0.66 at baseline and 0.73 at follow-up, and for the Social Provisions Scale 0.91 and 0.89 respectively. The correlation between the different dimensions of perceived togetherness varied between 0.44–0.71 at baseline and 0.39–0.88 at follow-up in the social intervention group and between 0.34–0.77 at baseline and 0.24–0.75 at follow-up in the self-directed group. To avoid multicollinearity owing to the rather high correlations, the different dimensions of perceived togetherness were analysed in separate models.

The social intervention group received more social attention and activity compared to the self-directed reference group. Thus, we first built the models estimating the associations between the variables separately for the social intervention and self-directed group. Each association was then tested for group equality using the likelihood ratio test (LRT). As the LRT showed significant worsening of model fit for group equality, path coefficients and 95 % confidence intervals are shown separately for the social intervention group (upper values in the figures) and self-directed group (lower values in the figures). As the models included both categorical and continuous variables, we used the robust mean- and variance-adjusted weighted least square estimator (WLSMV). As model fit indices, we report the Comparative fit index (CFI>0.95) due to its conceptual similarity to proportion variance explained, and root mean squared error of approximation (RMSEA<0.06) as a measure of adequacy between model and observed data (see Skrondal & Rabe-Hesketh 2004 for further details). The analyses were performed with MPLUS version 5.21 (Muthén & Muthén, 1998-2009). The proportion of missing data in the individual variables varied between 0 and 3.6 %. The Multiple Imputation (MI) procedure of SAS for Windows (version 9.1) was used to impute missing values using

available information on sociodemographic factors; physical and cognitive health and functional capacity; social relationships, loneliness, and perceived togetherness; and depressive symptoms and quality of life.

Results

Mean participant age was 77.0 years at baseline, 75 % were women, and 65 % lived alone (Table 1). In cognitive functioning (MMSE), the mean score was 27.2 and the mean number of chronic diseases was 2.9. Approximately 40 % of participants reported difficulties in at least one mobility task. The mean number of depressive symptoms was 3.6, and 31 % of participants had at least mild depression ($GDS \geq 5$). Two-thirds of the participants reported experiencing loneliness at least sometimes at baseline and one-half at follow-up. Experiences of perceived togetherness were highest in guidance and reliable alliance, and lowest in reassurance of worth and opportunity for nurturance at both baseline and follow-up. No significant differences were observed between the groups in either the background or studied variables.

[Table 1 near here]

The baseline and follow-up values of the dimensions of perceived togetherness, depressive symptoms, and loneliness correlated statistically significantly. After controlling for the previous measurements of each variable studied, the analyses revealed only a few cross-lagged links from the dimensions of perceived togetherness to depressive symptoms. A higher level of attachment in all participants and opportunity for nurturance in the social intervention group at baseline predicted fewer depressive symptoms at follow-up (Figures 2–3). No cross-lagged associations were observed between the dimensions of perceived togetherness at baseline and loneliness at follow-up.

However, several cross-lagged associations were observed between baseline loneliness and depressive symptoms and the follow-up dimensions of perceived togetherness. Lower feelings of loneliness at baseline predicted higher perceived social integration, guidance, and reliable alliance at follow-up (Figure 4, other figures not shown are available on request). Fewer depressive symptoms at baseline preceded higher perceived attachment, social integration, guidance, and reassurance of worth at follow-up (Figures 2, 4).

In addition to cross-lagged associations, cross-sectional associations between the dimensions of perceived togetherness and depressive symptoms and feelings of loneliness were observed. At baseline, higher perceived attachment, guidance, and reliable alliance were related to a lower level of loneliness (Figure 2). At follow-up, higher perceived attachment and opportunity for nurturance were associated with a lower level of loneliness (Figures 2–3). All the dimensions of perceived togetherness were associated with fewer depressive symptoms at baseline, and all, except for attachment, at follow-up (Figures 2–4). In general, the cross-sectional associations between the variables in the groups were similar. However, the groups differed in that higher perceived opportunity for nurturance at baseline was related to fewer depressive symptoms at follow-up in the social intervention group. In addition, at follow-up, higher perceived social integration, guidance, and reliable alliance were associated with fewer depressive symptoms, but only in the social intervention group.

[Figures 2-4 near here]

Of the variables adjusted for, living alone was associated with a higher level of loneliness at baseline in all models. Living alone was also associated with a lower level of attachment. Living alone and perceived difficulties in mobility were associated with a lower level of opportunity for nurturance at baseline. At follow-up, perceived difficulties in mobility were related to depressive symptoms.

All the cross-lagged models fitted the data well. In the models in which attachment, guidance, and reliable alliance were analyzed as potential explanatory factors for depressive symptoms and loneliness, the CFI values were 1.000 and RMSEA values less than 0.0005. In the model for social integration, the CFI value was 1.000 and RMSEA 0.004. For reassurance of worth, the respective values were 0.970 and 0.055, and for opportunity for nurturance 0.995 and 0.022.

Discussion

Based on Weiss' (1973; 1974) theoretical model of social provisions and on earlier studies we hypothesized that deficits in the dimensions of perceived togetherness are related to experiences of loneliness and depressive symptoms in older people. Cross-lagged modeling revealed, however, that after controlling for baseline depressive symptoms and loneliness, experiences of attachment in all participants and opportunity for nurturance in the social intervention group were the sole dimensions of perceived togetherness that predicted depressive symptoms at follow-up. No cross-lagged associations between perceived togetherness at baseline and loneliness at follow-up were observed.

This study extends the earlier knowledge by providing evidence based on longitudinal analyses that allowed us to take into account stability in loneliness and depressive symptoms. Weiss (1973, 17) theorized that "loneliness appears always to be a response to the absence of some particular relational provision". Thus, he indicated that a deficit in the dimensions of perceived togetherness should be an antecedent of loneliness. Several earlier cross-sectional studies have provided indirect evidence for the theory by observing that deficits in the dimensions of perceived togetherness are more prevalent among people who report loneliness than among those who do not (Drageset et al., 2012; Tiikkainen & Heikkinen, 2005).

However, after controlling for the baseline scores and cross-sectional associations of the characteristics in question, the results of our longitudinal analyses do not indicate that deficits in the dimensions of perceived togetherness are antecedents of loneliness. Instead, our results suggest that lower scores in the dimensions of perceived togetherness may describe features of loneliness, or even that loneliness precedes the dimensions of perceived togetherness. The theory of social provisions and loneliness has not properly been tested in a comparable longitudinal study earlier.

For depressive symptoms, our findings do not contradict those of earlier studies. Weiss (1973, 148) states: “Each form of loneliness is marked by restless depression and amorphous, unfocused dissatisfaction.” Thus, an explicit association is suggested between perceived togetherness and depression. Our results, like those of earlier studies, show that reassurance of worth is related to depressive symptoms (Russell & Cutrona, 1991; Tiikkainen & Heikkinen, 2005) or to other indicators of emotional well-being (Stephens et al., 2011). There are also differences with earlier studies. While Russell and Cutrona (1991) found that reliable alliance predicted fewer depressive symptoms, we found that higher perceived attachment and opportunity for nurturance predicted fewer depressive symptoms. It is possible that in different life situations and phases different dimensions of social togetherness become more central to mental wellbeing. In old age, having opportunities for nurturance and reassurance of worth may increase individuals’ experiences of mattering to others and so give meaning to life, thereby reducing the risk for depression (Boman, Gustafson, Häggblom, Santamäki Fischer, & Nygren, 2015; Taylor & Turner, 2001; Van, Dezutter, & Beyers, 2015).

The cross-sectional associations between the dimensions of perceived togetherness and loneliness and depressive symptoms found in our study are in line with Weiss’ theory (1974) and the results other empirical studies (see Cutrona et al., 1986; Drageset et al., 2012; Russell & Cutrona, 1991; Tiikkainen & Heikkinen, 2005). In our study, attachment seemed to be

important dimension of perceived togetherness in relation to depressive symptoms and feelings of loneliness. Weiss (1973) suggested that emotional loneliness appears in the absence of a close reliable emotional attachment. In the present study, lower attachment at both baseline and follow-up coexisted with loneliness and predicted depressive symptoms at follow-up. Attachment stems from a sense of safety, security, and being loved, which are most often experienced in relationships with one's spouse or close friends (Weiss, 1973). Deficit in attachment may underlie earlier findings that people living alone (Routasalo et al., 2006), not married (Jakobsson & Hallberg, 2005) or reporting lack of friends (Savikko et al., 2005) experience loneliness more often than others. Fulfilment of the need for attachment in one's social relationships may provide a sense of mattering to others, which in turn, reduces the risk for depression (Taylor & Turner, 2001).

Instead of cross-lagged associations from perceived togetherness at baseline to loneliness and depressive symptoms at follow-up, we found several cross-lagged associations in the reverse direction, i.e. from loneliness and depressive symptoms at baseline to perceived togetherness at follow-up. A higher level of loneliness at baseline was associated with a lower sense of guidance, reliable alliance, and social integration at follow-up. A higher score on depressive symptoms at baseline was related to lower feelings of attachment, social integration, guidance, and reassurance of worth at follow-up. This is in line with the results of a six-month follow-up study on the predictors of social support in older people by Cutrona and colleagues (1986). They formed a latent factor describing baseline mental health by combining life satisfaction, loneliness, and depressive symptoms. They found that mental well-being at baseline predicted perceived togetherness at follow-up. A possible explanation for this finding is that a depressed person or somebody suffering from loneliness may not have the energy for social contacts. In addition, feelings of loneliness and depressive mood may evoke negative thoughts and thus impair perceptions of togetherness. Negative emotional states narrow a

person's outlook on life (Fredrickson, 2009) while positive emotions broaden thought-action repertoires and expand awareness, allowing people to take in more contextual information, at least temporarily (Fredrickson, 2001; Fredrickson, 2013).

One finding in the present study may stem from the study design. In the social intervention group but not in the self-directed group, higher perceived social integration, guidance, and reliable alliance at follow-up were associated with fewer depressive symptoms at follow-up. Joining a group may decrease preferences for staying at home, perceptions of having lost valued activities, feelings that life is empty, or perceiving other people are better off than oneself, all of which are items rated in the Geriatric Depression Scale (Greenberg, 2007).

The present findings raise the question as to which comes first, perceived togetherness, loneliness or depressive symptoms. Our findings lay the foundation for future research on whether the dimensions of perceived togetherness may in fact be features of depressive symptoms and loneliness or even their consequences rather than their antecedents. The findings suggest that having a lower level of depressive symptoms and loneliness may be antecedents of perceived togetherness rather than vice versa. However, we cannot rule out the possibility of a reciprocal relationship. It would be important to approach loneliness from various aspects as it has many different causes. Theories of loneliness emphasize factors relating to personality or traits, or various situations in a person's life. Loneliness may be associated with the loss of a confidant and the resultant grief, lack of meaningful social relationships, dissatisfaction with existing relationships, existential questions, deficits in early attachment relationships, or shyness and fears in social situations.

This study has weaknesses as well as strengths. First, the longitudinal design and the cross-lagged modelling were strengths. In cross-lagged models, baseline measurements and their stability can be incorporated into the analyses. Longitudinal cross-lagged associations

describe existing associations between variables and provide evidence indicative of causality. However, we estimated models including both cross-sectional and longitudinal pathways. Cross-lagged modeling allowed us to include several variables in the analyses at the same time, and to inspect the simultaneous links between them. Analyzing the different dimensions of perceived togetherness in separate models rendered detectable differences in the associations of these dimensions with loneliness and depressive symptoms. Second, the results of the study may be generalized to community-dwelling older people experiencing some degree of loneliness or melancholy. In health and socio-economic situation, participants were comparable to those who did not meet the study inclusion criteria of experiencing feelings of loneliness or melancholy. Third, the study broadened understanding of the possible relations between the dimensions of perceived togetherness, loneliness, and depressive symptoms among older people.

A weakness of the study is that we assessed loneliness with a single question, which does not allow a distinction to be made between emotional and social loneliness (Weiss, 1973). However, the question is understandable, has good content validity, and measures loneliness directly as perceived by the respondents (Bowling, 2005). Another weakness related to the purpose of the study is that the analyses utilized data from a randomized controlled trial. However, since the groups randomized for the study were alike in most of the variables of interest and the initial design was taken into account in the analyses, we do not believe that this materially biased the results. The participants reported feelings of loneliness or melancholy at study entry, as these were inclusion criteria for the original intervention study. Consequently, our study included a larger proportion of people feeling loneliness and depressive symptoms and fewer people with high emotional wellbeing compared to the general population of corresponding age. In this sense, the distribution was truncated. Of the participants, 31 % had depressive symptoms ($GDS \geq 5$) (Greenberg, 2007), and 14 % reported

having feelings of loneliness often or continuously and 55 % have such feelings sometimes. In an earlier study among a representative sample in a similar geographical area, 5 % reported feeling lonely often or almost always (Tiikkainen & Heikkinen, 2005). A truncated distribution typically leads to the underestimation of associations. Consequently, we cannot rule out the possibility that the lack of cross-lagged associations between the dimensions of perceived togetherness at baseline and feelings of loneliness at follow-up are due to the sample, in which loneliness and depressive mood may be more stable than in a population with a wider range of characteristics. However, selecting the sample with characteristics that we wished to study is not a weakness, as it captures a high enough prevalence to enable multivariate analyses.

Conclusion: Among older people, depressive symptoms and loneliness may be precursors of the dimensions of perceived togetherness, rather than perceived togetherness being an antecedent of loneliness and depressiveness. Further longitudinal studies are needed in diverse populations to confirm these findings.

Practical implications include, first, importance of taking into account depressive symptoms and loneliness and their relation to experiences of perceived togetherness, and second, provision of opportunities for older people to give support for other people e.g. by promoting volunteering.

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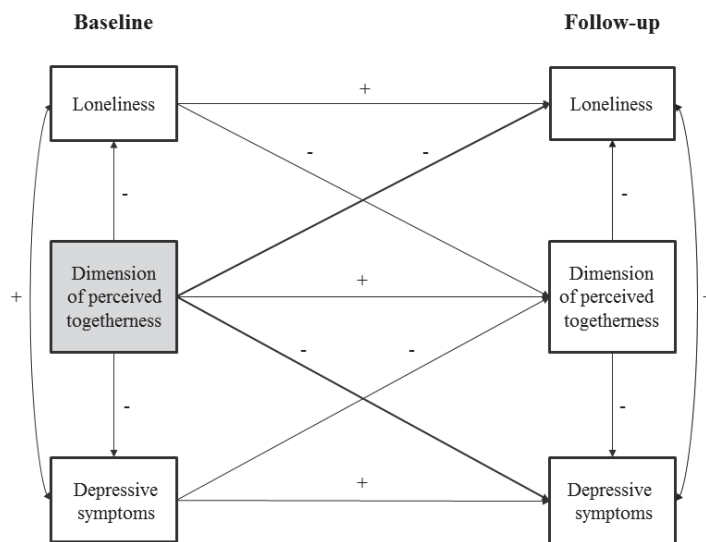
Table 1. Means, standard deviations (sd), and proportions of characteristics in participants of the GoodMood study at baseline and at six-month follow-up (n=222).

	Baseline^a	Follow-up^a
	Mean (sd)	Mean (sd)
Age	77.0 (1.43)	-
Number of chronic diseases	2.9 (1.61)	-
Mobility^b	10.9 (1.81)	10.9 (1.83)
Cognitive functioning	27.2 (2.07)	-
Depressive symptoms	3.6 (2.45)	3.5 (2.68)
Social integration	12.5 (2.16)	12.9 (2.05)
Attachment	12.3 (2.42)	12.9 (2.23)
Guidance	12.8 (2.47)	13.4 (2.05)
Reliable alliance	13.1 (2.23)	13.3 (2.04)
Opportunity for nurturance	11.8 (2.53)	11.9 (2.64)
Reassurance of worth	11.7 (2.03)	12.0 (1.84)
	%	%
Women	75.2	-
Lives alone	65.3	-
Loneliness		
-no/very rarely	31.5	50.9
-sometimes	54.5	37.8
-often or continuously	14.0	11.3

Note ^a=Any differences between the social intervention and self-directed groups were not observed in the variables shown in the table.

Note ^b= Sum of the variables of perceived ability to walk outdoors 2km, 0,5km, walk indoors, and climb stairs. 0=Is not able, 1=Need other person to help, 2=Is able but has difficulties, 3=Is able, no difficulties.

Figure 1. Theoretical model linking the dimensions of perceived togetherness, depressive symptoms, and feelings of loneliness.



Note 1. Results for dimensions of perceived togetherness (attachment, social integration, guidance, reliable alliance, opportunity for nurturance, reassurance of worth) are shown in separate figures.

Note 2. +: theoretically positive coefficient; -: theoretically negative coefficient.

Note 3. Thicker lines highlight the cross-lagged associations of primary interest.

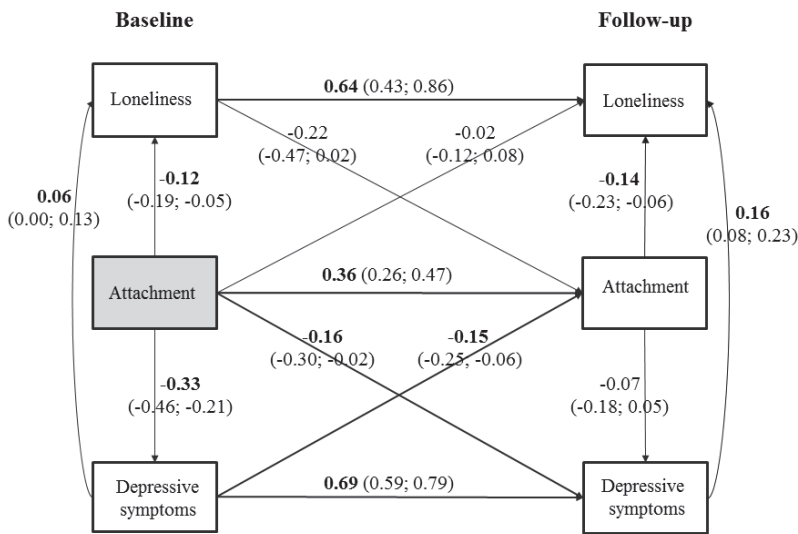


Figure 2. Unstandardized coefficients (95 % confidence intervals) of cross-lagged model with six-month follow-up for perceived attachment, depressive symptoms, and loneliness adjusted for living alone and perceived difficulties in mobility (n=222).

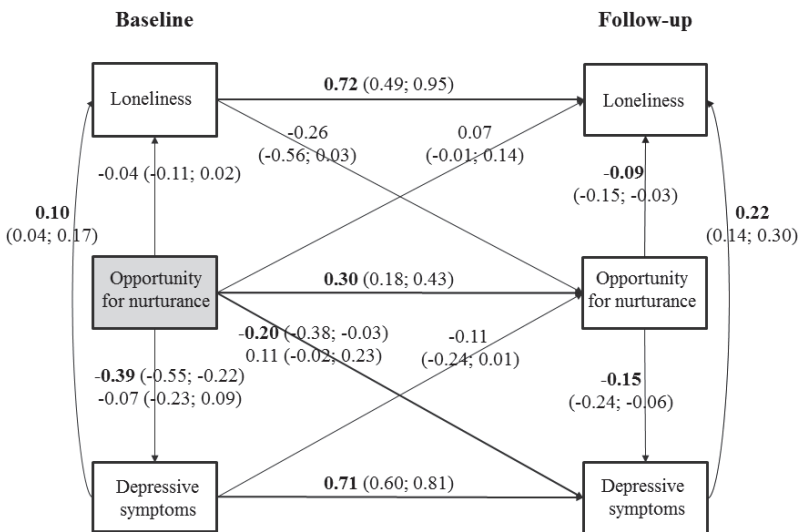


Figure 3. Unstandardized coefficients (95 % confidence intervals) of cross-lagged model with six-month follow-up for perceived opportunity for nurturance, depressive symptoms, and loneliness adjusted for living alone and perceived difficulties in mobility (n=222).

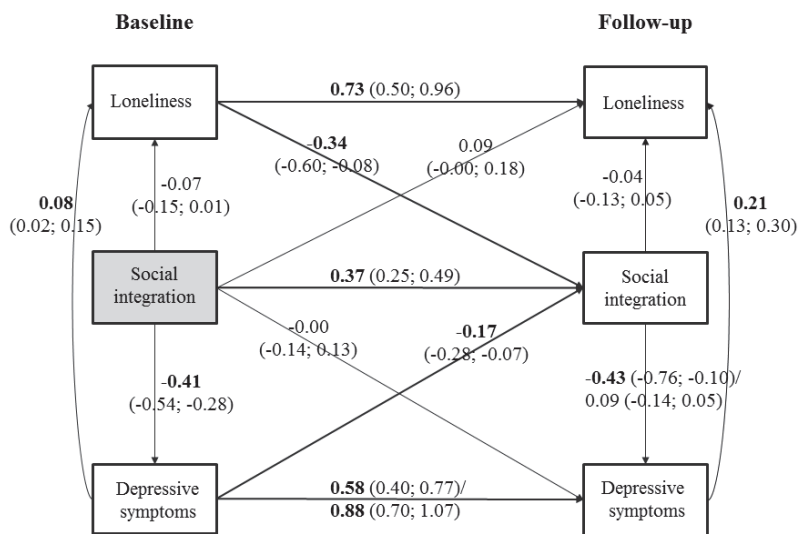


Figure 4. Unstandardized coefficients (95 % confidence intervals) of cross-lagged model with six-month follow-up for perceived social integration, depressive symptoms, and loneliness adjusted for living alone and perceived difficulties in mobility (n=222).

Note: When the association cannot be set equal between the groups, the upper value is the value of the social intervention group and the lower value is the value of the self-directed group.

IV

EFFECT OF A SOCIAL INTERVENTION OF CHOICE VS. CONTROL ON DEPRESSIVE SYMPTOMS, MELANCHOLY, FEELING OF LONELINESS, AND PERCEIVED TOGETHERNESS IN OLDER FINNISH PEOPLE: A RANDOMIZED CONTROLLED TRIAL

by

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Effect of a social intervention of choice vs. control on depressive symptoms, melancholy, feeling of loneliness, and perceived togetherness in older Finnish people: a randomized controlled trial

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ABSTRACT

Objectives: This study examined effects of a social intervention on depressive symptoms, melancholy, loneliness, and perceived togetherness in community-dwelling Finnish older people.

Method: Promotion of mental well-being in older people (GoodMood; ISRCTN78426775) was a single-blinded randomized control trial lasting 1.5 years. Two hundred and twenty-three persons aged 75–79 years reporting symptoms of loneliness or melancholy were randomized into intervention and control groups. The intervention group was allowed to choose among supervised exercise, social activity, or personal counseling. Follow-up measurements were conducted at the end of 6-month intervention, and at 3, 6, and 12 months post intervention.

Results: Number of depressive symptoms remained unchanged, while loneliness and melancholy decreased in both the intervention and control groups during the study ($p < 0.001$). Social integration increased in the intervention group but not in controls ($p = 0.041$). Attachment and guidance increased in both groups ($p < 0.001$).

Conclusion: The intervention did not alleviate depressed mood. Positive changes over time were observed in loneliness, feelings of melancholy, attachment, and guidance but these occurred independently of the intervention. Our secondary analysis suggests that the intervention increased perceived social integration. In sum, the effects of the intervention were moderate only and did not expedite further overcoming depressive mood or loneliness.

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Depressive symptoms;
loneliness; social integration;
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Introduction

Declining health and changes in a person's social network with aging may threaten the maintenance of mental well-being in older people. However, older people who have access to social relations in which they experience mutual proximity and security and through which they can get help when they need it, suffer less often from feelings of loneliness and depressive symptoms (Tiikkainen & Heikkinen, 2005). Other observational studies have shown that the incidence of depressive symptoms is lower among people involved in social activity (Glass, Mendes de Leon, Bassuk, & Berkman, 2006; Wahrendorf, Ribet, Zins, & Siegrist, 2008). However, intervention studies suggest that alleviating loneliness and depressive symptoms in older people may not be as straightforward as the observational studies suggest. In a systematic review, Dickens, Richards, Greaves, and Campbell (2011) concluded that only 3 out of 12 group interventions were effective in reducing loneliness and 3 out of 8 effective in alleviating depression.

Loneliness may be defined as an unpleasant, anxiety-inducing subjective experience resulting from inadequate social relationships (Peplau & Perlman, 1982). The association between loneliness and social contacts has been addressed in several studies. An important predictor of loneliness is living alone (Routasalo, Savikko, Tilvis, Strandberg, & Pitkälä, 2006). Receiving fewer visits from friends and having a less extensive social network were also related to loneliness (Adams,

Sanders, & Auth, 2004). However, the frequency of contacts may not be paramount. Routasalo et al. (2006) found that the feeling of loneliness was associated not with the frequency of contacts with children and friends, but with satisfaction with these contacts. Thus, especially qualitative aspects of social contacts count for feelings of loneliness.

Depression is a broader phenomenon than loneliness, as it may result from changes in social relationships or in non-social situations (Peplau & Perlman, 1982). Earlier studies have shown, for example, that chronic diseases, disability, poor self-rated health, poor vision, perceived negative changes in life, lack of a friendly companion, less participation in organized social activities, and irritation with one's family are predictors of depressive symptoms (see Adams et al., 2004; Heikkinen & Kauppinen, 2004; Kaneko, Motohashi, Sasaki, & Yamaji, 2007; McGuire, Strine, Allen, Anderson, & Mokdad, 2009). Grieving over a recent loss of a close person was associated with both depressive symptoms and loneliness (Adams et al., 2004). Depressive symptoms and loneliness are strongly associated, and often co-occur both with each other and other setbacks in life. It is possible that loneliness and depressive symptoms can act in a synergistic way to impair well-being in older people (Cacioppo, Hughes, Waite, Hawkey, & Thisted, 2006).

The qualitative aspect of social interaction can be described by the concept of perceived togetherness, which is grounded in Weiss's (1974) idea that people need various

kinds of social relationships to fulfill their various social needs. Perceived togetherness describes the way people experience their social interaction and the social support they receive (Tiikkainen, Heikkinen, & Leskinen, 2004). According to Weiss (1973), feelings of loneliness may result from a deficit in one or more relational functions: attachment, social integration, sense of reliable alliance, guidance, nurturance, and reassurance of worth. Emotional loneliness arises from the lack of an intimate relationship or a confidant, whereas social loneliness refers to negative feelings resulting from the absence of meaningful relationships and social integration. Tiikkainen and Heikkinen (2005) found that, among 80-year-old persons, loneliness correlated with the lack of reliable alliance, social integration, and attachment, while depressive symptoms were explained by low scores in guidance, reassurance of worth, reliable alliance, and attachment. Thus, experiencing insufficiently met social needs may negatively affect mental well-being. Although all six relational functions are important to older people, their relative importance may vary depending on age and life situation.

Previous systematic reviews concluded that interventions that were effective in decreasing loneliness were typically conducted in a group setting, involved some form of educational or training input and social activity, and in which older people were active participants (Cattan, White, Bond, & Learmouth, 2005; Dickens et al., 2011). For older women living alone, discussion on health-related topics reduced their feelings of loneliness (Anderson, 1985). A group intervention focusing on self-management abilities attenuated social loneliness in older women (Kremers, Steverink, Albersnagel, & Slaets, 2006). A group intervention including therapeutic writing and group psychotherapy or physical exercise and discussion or art activities, increased psychological well-being in older participants suffering from loneliness (Routasalo, Tilvis, Kautiainen, & Pitkala, 2009). In addition, reminiscence and life review have been reported to be potentially effective methods for the enhancement of psychological well-being (Bohlmeijer, Roemer, Cuijpers, & Smit, 2007), and for treating depressive symptoms in older adults (Bohlmeijer, Smit, & Cuijpers, 2003). A group-based exercise training program was more effective than individual home exercise in improving mood in older women (Timonen, Rantanen, Timonen, & Sulkava, 2002).

Among the Finnish community-dwelling older population, approximately 5% report feeling lonely often or almost always (Savikko, Routasalo, Tilvis, Strandberg, & Pitkala, 2005; Tiikkainen & Heikkinen, 2005) and 39% suffer from loneliness at least occasionally (Routasalo et al., 2006). Heikkinen and Kauppinen (2004) found that over one-third of 75-year-old women and one-quarter of same age men were depressed, and that the proportion of depressed persons increased, particularly among women, from age 80 to 85 years. Minor depression among older people is typically a dynamic and episodic phenomenon (Heikkinen & Kauppinen, 2004). Similarly, loneliness often is a result of situational factors and may be transitory (Luanaigh & Lawlor, 2008). However, when depressive symptoms and loneliness become prolonged, a person may need support to recover. Regardless of the positive results of intervention studies on enhancing the mental well-being of elderly people, more intervention studies are called for to investigate cost-effective ways to mitigate loneliness and depressive mood in older people.

The objective of this study was to examine the effects of a social intervention on depressive symptoms, melancholy, loneliness, and perceived togetherness in community-dwelling Finnish people aged 75–79 years who reported depressed mood or loneliness at study entry. In addition, the aim was to study whether the parallel effects would be found across the three intervention subgroups, and between the depressed and not-depressed groups. The basic idea behind the intervention was that by giving the participants a possibility to interact and by promoting social integration their loneliness would decrease.

Methods

Design

The GoodMood, project, with the purpose of promoting mental well-being in older people, was a single-blinded randomized controlled trial (RCT) lasting 1.5 years. The specific aims of the project were to develop screening tools to identify persons with early signs of declining mental well-being, to develop counseling and group interventions promoting perceived togetherness and mental well-being, and to evaluate the impact of early intervention on depressive mood, loneliness, and participation in older people who were at increased risk for impaired mental well-being. GoodMood was carried out in co-operation with the GeroCenter Foundation for Research and Development, University of Jyväskylä, JAMK University of Applied Sciences, and the City of Jyväskylä, Finland. The Ethical Committee of the Central Finland Health Care District approved the study. All participants gave their written informed consent prior to the study.

The selection of the participants and study design are shown in Figure 1. The target population comprised of all the 75- to 79-year-old residents of Jyväskylä, Central Finland, who were living in the city center area in August 2008 ($N = 1167$). This age group is suitable for an intervention of this kind: although a large proportion of them will have some health issues, in most cases these are unlikely to be severe enough to restrict participation. Based on earlier studies, it was presumed that some 30%–40% of population in this age group would report symptoms of loneliness or melancholy (see e.g. Heikkinen & Kauppinen, 2004; Tiikkainen & Heikkinen, 2005), and that two-thirds would be willing to participate in a study of this kind (Leinonen et al., 2007). Therefore, we assumed adequate coverage of the target population. Contact information was gathered from the Finnish population register. Of the original target population of 1167 people, information on perceived loneliness and melancholy was obtained for 985 persons via phone screening. Of these, 24% reported feeling lonely and 37% melancholy at least sometimes. Altogether 50% reported feelings of melancholy or loneliness at least sometimes. All the inclusion criteria: (1) feeling loneliness, melancholy, or depressive mood at least sometimes, (2) a Mini-Mental State Examination (MMSE) score greater than 21 in order to be able to participate in discussions, and (3) willing to participate in the study, were met by 296 persons, of whom 39 withdrew from the study before randomization. After a more detailed structured face-to-face home interview between September and November 2008, the participants met a counselor once. The meeting included discussion of the participant's life situation and available social support. After completion of the screening and data collection process,

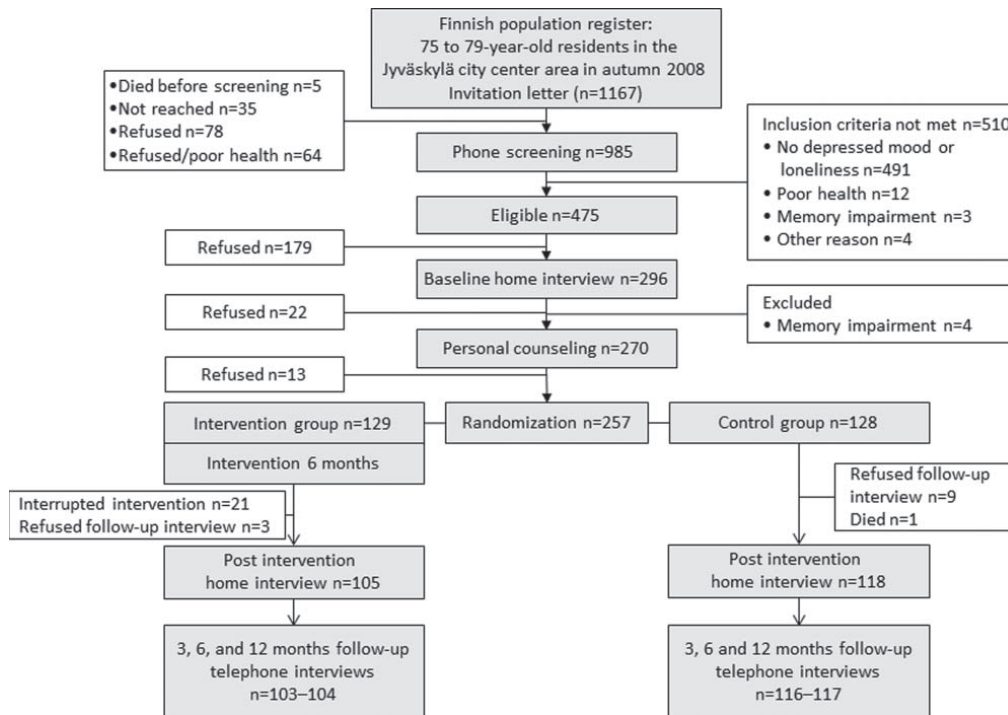


Figure 1. Flow of the study.

257 persons were allocated to the intervention or control groups, using a randomized ratio 1:1, by drawing lots. The trial administrator performed the randomization. Interviewers and data collecting assistants were blinded to the group assignment of the participants throughout the study. After the end of the six-month intervention, a larger follow-up face-to-face interview was carried out between April and June 2009, in the participants' homes. Shorter follow-up interviews were carried out by phone at 3, 6, and 12 months after the intervention ended. One participant died and 33 withdrew from the study during the intervention. Only the data on the persons who participated in both home interviews (intervention group $n = 105$, control group $n = 118$) were analyzed in this study.

Drop-outs did not differ from those who remained in the study in sex, self-rated health, or melancholy. A slightly larger proportion of participants lived alone (66% vs. 56%), felt lonely at least sometimes (68% vs. 52%), and did not have a supporting person in their network (22% vs. 13%) than drop-outs. At each stage, reasons most often given for withdrawal were lack of interest (24%), no expected benefit from participation (27%), lack of time (28%), and poor health (27%). In addition, drop-outs in the intervention group during the intervention did not differ significantly from drop-outs in the control group in depressive symptoms (mean Geriatric Depression Scale (GDS) 5.17 in the intervention group vs. 4.22 in the controls).

Measurements

The primary outcome of this study was information on depressive symptoms measured using a short form of the GDS. The

GDS is specially designed to screen for depressed mood in older adults. A larger score indicates greater severity of symptoms and the scale maximum is 15. The cut-off score for depression has most commonly been defined as ≥ 5 (see Greenberg, 2007). We used the summary score of the scale in the analyses.

The secondary outcomes were melancholy, feelings of loneliness, and dimensions of perceived togetherness. Melancholy was assessed with the question: 'How do you perceive your mood in general?' The response options were almost always good, sometimes melancholy, and often or almost always melancholy. The response options for the question 'Do you feel lonely?' were very rarely or never, sometimes, and often or almost always. Perceived togetherness was measured using the Social Provisions Scale developed on the basis of Weiss's theory (Cutrona & Russell, 1987). Its 24 items are equally divided between the six different dimensions or provisions: attachment, social integration, reliable alliance, guidance, opportunity for nurturance, and reassurance of worth. Attachment refers to social relationships which satisfy the need for proximity, affection and love, and which can promote feelings of security and well-being. Social integration refers to a sense of belonging to a group or community where people can share common concerns and exchange experiences. Reliable alliance refers to having a relationship one can turn to in an emergency. Guidance refers to having access to advice and assistance. Opportunity for nurturance means having the relationships in which a person feels responsible for the well-being of another. Reassurance of worth is possible in social relationships where the individual's skills and competencies are respected. Two of the four questions in each dimension

are positively and two negatively worded. On a scale from strongly disagree (scored 1) to strongly agree (scored 4), the respondents were asked to assess to what extent they thought that each statement described their current social relationships. The responses to the negatively worded items were reversed. A composite measure was calculated for each dimension with scores ranging between 4 and 16, where larger values indicated a more positive aspect. Depressive symptoms and perceived togetherness were assessed at baseline and at the end of the six-month intervention, and melancholy and feelings of loneliness were further assessed at the 3-, 6-, and 12-month post-intervention follow-up measurements.

Information on age (in years), sex, full-time education (level of schooling), perceived economic situation (good, moderate, or poor), living alone (yes/no), morbidity, cognitive functioning, and mobility were gathered during the face-to-face interviews. Morbidity was assessed by asking the participant to state what physician-diagnosed chronic diseases of more than three months' duration he or she currently had. Cognitive functioning was assessed with the MMSE (Folstein, Folstein, & McHugh, 1975). Mobility was assessed by asking about perceived difficulties in walking 2 km, 500 m, ambulating indoors, and climbing stairs. The response options for these were 'not able' (scored 0), 'not able without somebody to help' (scored 1), 'yes, but has difficulties' (scored 2), or 'yes, without difficulties' (scored 3). Summary measures were computed for mobility.

Intervention

The participants randomized to the intervention group were allowed to select from three alternatives the intervention regime they thought would benefit them the most (Table 1). The exercise program was the most favored ($n = 45$) followed by personal counseling ($n = 33$) and the social activity program ($n = 27$). The three regimes were similar in that each included social interaction, participants were able to influence the content of the meetings, and well-being was promoted. Participants in the exercise and the social activity programs met weekly altogether 19–21 times. The exercise program involved varying types of exercise and was conducted by qualified instructors in municipal gyms. The social activity program was delivered by health care students from JAMK University of Applied Sciences and participants met in the city library. Activities included group discussions, self-expression using art and creative methods, and going on day-trips. Personal counseling was conducted by a rehabilitation counselor

and meetings took place in a health care center. Meetings were held approximately every third week and each participant attended 4–5 meetings. The issues discussed in the meetings varied depending on what topics the participant considered important. Counseling was given when needed. The control group received one counseling session which took place prior to randomization. Controls had access to the usual services offered by the municipality and other service providers.

Statistical analysis

Generalized estimating equations (GEE) models were used to estimate parameters for group- and time-main effects and group-by-time interaction for depressive symptoms, melancholy, loneliness, and the dimensions of perceived togetherness. We report the type III effect p -values that are invariant to the choice of reference category. In the analyses, to optimize statistical power relative to the control group, we did not separate the three intervention subgroups but treated them as a single group. We then conducted ancillary GEE analysis for the intervention subgroups and for those above and below the GDS cut-off score (≥ 5). These analyses were performed with IBM SPSS Statistics, version 22.0. The proportion of missing data in individual variables varied between 0% and 3.6%. The Multiple Imputation procedure of SAS for Windows (version 9.1) was used to impute missing values using the available information from the model variables and on background characteristics, physical activity, and functional ability.

Results

Average participant age was 77.0 years at baseline, 75% were women, and 65% lived alone (Table 2). Mean MMSE score was 27.2 and mean number of chronic diseases was 2.9. Participants typically had only early signs of mobility decline as 35% reported difficulties only in walking longer distances (2 km) and 60% reported no difficulties in any mobility tasks. In depressive symptoms, melancholy, loneliness, and dimensions of perceived togetherness, the intervention and the control groups were comparable.

Primary outcome: the six-month intervention did not affect depressive symptoms. The number of symptoms remained at the same level over the six-month intervention (Table 3).

Secondary outcomes: Table 3 shows that feelings of loneliness and melancholy decreased in both the intervention and control groups. The improvement in melancholy (Figure 2)

Table 1. Number of participants and content of subgroup programs of the six-month intervention in the GoodMood project.

Intervention regime	n	Number of meetings	Frequency/length of meetings	Content of regime
Exercise program (three groups)	45	19–21	Once a week/one hour	Varied types of exercise, e.g. circuit training, training with step board or rubber band, planned with the participants. Aims were to exercise together, gain familiarity with various types of exercise, and enhance balance, muscle strength, and movement of joints.
Social activity program (two groups)	27	20–21	Once a week/two hours	Discussion in groups, using art and creative methods, exposure to esthetic experiences, day-trips. The focus was on sharing experiences and thoughts, and acquiring information on health-related topics.
Personal counseling	33	In most cases, 4–5 times per person (range 3–7)	Every third week/one hour	Discussion on topics important to a participant, and counseling using a solution-focused method. Focus on listening, appreciation of the person's experiences and goals, person's responsibility for his or her own well-being, and positive attitude and coping skills of the participant.

Table 2. Means, standard deviations (SD), and proportions of the baseline characteristics in the whole sample, in the intervention and control groups, and in the intervention regimes.

	All n = 223 Mean (SD)	Intervention group n = 105 Mean (SD)	Control group n = 118 Mean (SD)	Exercise program n = 45 Mean (SD)	Social activity program n = 27 Mean (SD)	Personal counseling n = 33 Mean (SD)
Age	77.00 (1.43)	77.02 (1.45)	76.91 (1.43)	77.00 (1.43)	76.93 (1.36)	77.12 (1.58)
Education ^a	10.36 (4.05)	2.61 (1.61)	2.91 (1.80)	2.73 (1.73)	3.11 (1.74)	2.03 (1.21) [^]
Economic situation ^b	2.30 (0.56)	2.28 (0.63)	2.32 (0.49)	2.24 (0.65)	2.22 (0.58)	2.36 (0.65)
MMSE score	27.22 (2.07)	27.08 (2.14)	27.35 (2.00)	26.73 (2.30)	27.96 (0.74)	26.82 (2.07) [^]
Number of chronic diseases	2.85 (1.61)	2.91 (1.64)	2.79 (1.58)	2.64 (1.75)	3.04 (1.43)	3.18 (1.65)
Mobility ^c	10.89 (1.84)	10.78 (1.95)	10.99 (1.74)	11.20 (1.80)	10.81 (1.67)	10.18 (2.23) [^]
Depressive symptoms	3.68 (2.52)	3.91 (2.71)	3.47 (2.33)	3.38 (2.52)	3.78 (2.74)	4.76 (2.82) [^]
Attachment	12.28 (2.43)	12.06 (2.73)	12.48 (2.10)	12.38 (2.54)	11.85 (2.96)	11.79 (2.84)
Social integration	12.54 (2.16)	12.30 (2.17)	12.75 (2.15)	12.24 (2.27)	12.85 (2.07)	11.94 (2.09)
Alliance	13.07 (2.22)	12.90 (2.36)	13.23 (2.09)	13.11 (1.89)	12.78 (2.85)	12.8 (2.54)
Guidance	12.84 (2.48)	12.56 (2.64)	13.08 (2.31)	12.96 (2.22)	12.52 (3.18)	12.06 (2.86)
Nurturance	11.85 (2.54)	11.60 (2.74)	12.07 (2.34)	12.31 (2.44)	11.48 (2.77)	10.73 (2.92)
Reassurance of worth	11.74 (2.03)	11.61 (2.01)	11.86 (2.04)	12.16 (1.81)	11.81 (1.24)	10.70 (2.46) [*]
	%	%	%	%	%	%
Women	75.3	72.4	78.0	73.3	74.1	69.7
Lives alone	65.0	64.8	65.3	55.6	70.4	72.7
Melancholy						
• No/very rarely	17.9	17.1	18.6	22.2	14.8	12.1
• Sometimes	71.3	69.5	72.9	64.4	74.1	72.7
• Often or almost always	10.8	13.3	8.5	13.3	11.1	15.2
Loneliness						
• No/very rarely	31.8	33.3	30.5	37.8	37.0	24.2
• Sometimes	54.3	52.4	55.9	51.1	48.1	57.6
• Often or continuously	13.9	14.3	13.6	11.1	14.8	18.2
Hobby activity outside home						
• Not at all	12.1	12.4	11.9	13.3	7.4	15.2
• Few times a year	19.7	20.0	19.5	24.4	14.8	18.2
• 1–3 times per month	33.2	33.3	33.1	35.6	29.6	33.3
• At least weekly	35.0	34.3	35.6	26.7	48.1	33.3

Note: Differences between the exercise, social activity, and personal counseling regimes were tested with Independent-Samples Kruskal–Wallis Test: [^]p-value < 0.05; ^{*}p-value < 0.01.

^aEducation: 1 = Elementary school, 2 = Elementary school + vocational school, 3 = Middle school, 4 = Middle school + vocational school, 5 = Upper secondary school + vocational school, 6 = College graduate.

^bPerceived economic situation: 1 = Poor, 2 = Moderate, 3 = Good.

^cSum of the variables of perceived ability to walk outdoors 2 km, 0.5 km, walk indoors, and climb stairs. 0 = Is not able, 1 = Needs help, 2 = Is able but has difficulties, 3 = Is able, no difficulties.

and loneliness (Figure 3) remained up to the 12-month post-intervention follow-up. Of the dimensions of perceived togetherness, guidance and attachment increased in both groups during the six-month intervention. Time and group-by-time interaction effects were statistically significant for social integration indicating positive change only in the intervention group.

Ancillary analyses conducted for the intervention regimes did not add to the existing results. In each regime, social integration, attachment, and guidance increased, and feelings of loneliness and melancholy decreased during the six-month intervention. One difference between regimes was observed in reassurance of worth. Participants who chose personal counseling reported less often than those in the exercise group that they felt their individual's skills and competencies were respected.

Ancillary analyses among those who were categorized as depressed (GDS score ≥ 5 ; $n = 36$ in the intervention and 34 in the control group) or non-depressed (GDS score 1–4; $n = 69$ in the intervention and 84 in the control group) revealed no additional information on the effectiveness of the intervention. Overall, while the time effects indicated that depressive symptoms decreased among those who were depressed and loneliness decreased among those who were non-depressed, the changes were similar in the intervention and the control groups. As a consequence of the intervention, social integration increased only among those who were non-depressed at baseline.

Discussion

The results of our study showed that the intervention did not alleviate depressed mood. Feelings of loneliness and melancholy decreased and perceived attachment and guidance increased over time similarly in both the intervention and control groups. The intervention was efficacious in increasing social integration. However, changes in social integration and feelings of loneliness were observed only among those who felt lonely but were not depressed.

Our results add to the diversity of previous findings on the effectiveness of interventions in reducing depressiveness or loneliness in older people. Some randomized controlled trials have reported a decrease in depressive symptoms (Bohlmeijer et al., 2003; Constantino, 1988; Pinquart, Duberstein, & Lyness, 2007; Timonen et al., 2002) or loneliness (Anderson, 1985; Ollonqvist et al., 2008). Other targeted interventions, however, have not been successful in alleviating depressive mood (Arnetz, Theorell, & Arnetz, 1983; White et al., 2002) or loneliness (Routasalo et al., 2009; White et al., 2002). We designed our intervention based on studies that had obtained positive results, but we were not able to detect additional benefits with respect to loneliness, melancholy, and depressive symptoms beyond those achieved naturally over time. Some other studies have similarly reported that, e.g. loneliness was also attenuated in the control group during the study (Kremers et al., 2006; see e.g. Martina & Stevens, 2006).

Improvements in depressive symptoms among those who were depressed at baseline, and in feelings of melancholy

Table 3. Means, standard deviations, and generalized estimating equations (GEE) model parameters for time-, group-, and group-by-time interaction for depressive symptoms, melancholy, loneliness, and dimensions of perceived togetherness in the intervention ($n = 105$) and control ($n = 118$) groups at baseline and after the six-month intervention.

	Mean (standard deviation)				<i>p</i> -value for type III GEE model effects ^Δ		
	Baseline		After six-month intervention		Time	Group	Group × time
	Intervention group	Control group	Intervention group	Control group			
Depressive symptoms	3.91 (2.71)	3.47 (2.33)	3.73 (2.86)	3.32 (2.61)	0.204	0.191	0.885
Social integration	12.30 (2.17)	12.75 (2.15)	12.92 (2.00)	12.77 (2.18)	0.027	0.553	0.041
Alliance	12.90 (2.36)	13.23 (2.09)	13.04 (2.35)	13.54 (1.77)	0.103	0.098	0.542
Guidance	12.56 (2.64)	13.08 (2.31)	13.22 (2.35)	13.54 (1.90)	0.001	0.106	0.550
Attachment	12.06 (2.73)	12.48 (2.10)	12.70 (2.44)	12.93 (2.10)	0.001	0.233	0.534
Nurturance	11.60 (2.74)	12.07 (2.34)	11.71 (3.00)	12.11 (2.28)	0.678	0.143	0.849
Reassurance of worth	11.61 (2.01)	11.86 (2.04)	11.65 (1.91)	12.17 (1.80)	0.174	0.088	0.286
Melancholy	%	%	%	%	0.001	0.190	0.785
• No/very rarely	17.1	18.6	26.7	33.9			
• Sometimes	69.5	72.9	63.8	59.3			
• Often or almost always	13.3	8.5	9.5	6.8			
Loneliness					<0.001	0.487	0.578
• No/very rarely	33.3	30.5	53.3	48.3			
• Sometimes	52.4	55.9	36.2	39.0			
• Often or continuously	14.3	13.6	10.5	12.7			

^ΔDifferences were tested with Generalized Linear Models, bold typeface indicates effect significant at the level 0.05 significance level.

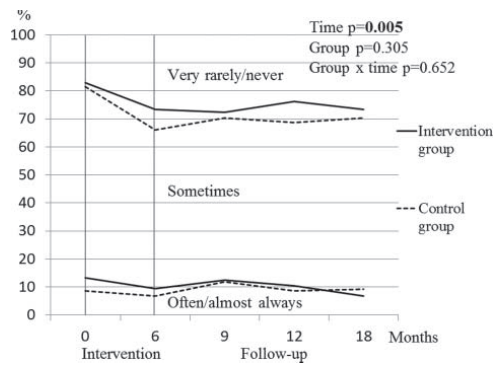


Figure 2. Proportions of participants (in the intervention, $n = 105$ and control, $n = 118$ groups) reporting feelings of *melancholy* at baseline, after the 6-month intervention, and at 3, 6, and 12 months post-intervention follow-ups, and generalized estimating equations (GEE) model parameters for time-, group-, and group-by-time interaction for the whole follow-up period.

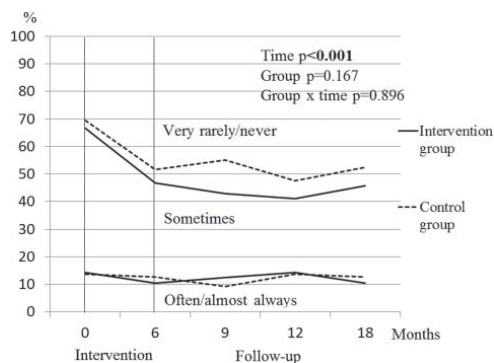


Figure 3. Proportions of participants (in the intervention, $n = 105$ and control, $n = 118$ groups) reporting feelings of *loneliness* at baseline, after the 6-month intervention, and at 3, 6, and 12 months post-intervention follow-ups, and generalized estimating equations (GEE) model parameters for time-, group-, and group-by-time interaction for the whole follow-up period.

and loneliness in the whole study group over time may partly result from the attention participants received during the study. In addition to a home interview, each participant had a meeting with a counselor at baseline. This may also have brought about an increase in perceived guidance and attachment in both groups. Another explanation may be the Hawthorne effect, according to which people behave differently just because they know that they are being studied (see Becker, Roberts, & Voelmeck, 2003). It is also possible that simply reporting about their feelings of loneliness and melancholy, social relationships, and activities outside the home led the control group members to independently make efforts to change their situation, which was subsequently reflected in reduced loneliness and melancholy.

In our study, the intervention did not expedite the process of overcoming the depressive mood or loneliness. However, a more individualized therapeutic perspective might have resulted in an improvement in depressiveness (see Pinquart et al., 2007). Loneliness may be difficult to alleviate as it has many different causes and perceived deficiencies in social relationships affect loneliness in many different ways. Theories of loneliness emphasize factors relating to personality or traits, or various states in a person's life. Loneliness may be associated with the loss of a confidant and the resultant grief, lack of meaningful social relationships, dissatisfaction with existing relationships, existential questions, deficits in early attachment relationships, or shyness and fears in social situations. These matters should be taken into account and interventions targeted accordingly.

In this study, social integration increased in the intervention but not in the control group. Social integration refers to experiencing oneself as part of group or having people around one who like the same social activities, think the same way about things, have the same interests and concerns, and like to do things in the same way as oneself. Lack of social integration is associated with social loneliness and might best be resolved by acquiring new contacts. In a pilot study focusing on older people who were clients of home health care, receiving volunteer visitors during a period of six weeks improved older persons' perceived social integration (MacIntyre et al., 1999). Meeting peers in a group setting or a counselor in a one-to-one setting may offer the older person positive stimulation along with emotional support and

attention (see the multidimensional model of affiliation in Hill, 1987, 2009) which, in turn, may enhance the experience of acceptance and belonging (see Leary & Kelly, 2009). All three intervention regimes in our study included social interaction and were participatory, which may explain the findings.

Participants were allowed to choose from three possible regimes selected on the basis of the results of previous studies. This was done because the opportunity to choose enhances the experience of control over one's life and the motivation to complete the intervention (see Mannell & Kleiber, 1997, p. 144). In our study, the proportion of drop-outs from the intervention group was 16%, whereas in studies offering the same intervention regime to all participants, the drop-out rate has ranged from 20% to 27% (Kremers et al., 2006; Ollonqvist et al., 2008; White et al., 2002).

Depressive symptoms were measured with the GDS, which has been found to be a good screening tool for depressive symptoms among older adults (e.g. de Craen, Heeren, & Gussekloo, 2003) and has been observed to detect changes in depressive symptoms. In a study among 85-year-old persons who experienced a major negative life event, the shorter form of the GDS was able to detect a change in their depressive symptoms (Vinkers, Gussekloo, Stek, Westendorp, & Van Der Mast, 2004). The meta-analysis by Pinquart et al. (2007) concluded that the GDS detected improvements in depressive symptoms. Consequently, we believe that GDS is valid and reliable and that the present result is not an outcome of deficiencies in the assessment scale.

This study has both strengths and weaknesses. One weakness may be that we assessed loneliness with a single question which does not enable a distinction to be drawn between emotional and social loneliness, or between the state and trait aspects of the experience (Luanaigh & Lawlor, 2008). However, the question is understandable and generally acceptable, and measures loneliness directly (Bowling, 2005). In addition to loneliness, we measured perceived togetherness, which is a positive perspective on social relationships that correlates negatively with feelings of loneliness.

The strengths of the study were its sampling and screening methods and design. First, the target population included all the residents in a particular age group living in a certain geographical area. Those recruited, based on their feeling of loneliness or melancholy, were otherwise comparable with those who did not meet the study inclusion criteria. Compared to studies based on non-probability or convenience samples, our study gives a more realistic picture of the prevalence of loneliness and melancholy among older people and of the possibilities to alleviate these problems. Second, those who dropped out during the study did not differ in their feelings of melancholy from those who continued their participation in the study. Third, having a control group in the study allowed to conclude that the observed positive changes happened over time independent of the intervention. Had we not had a control group, we would likely have concluded that the intervention alleviated the problems, which would have been a misleading interpretation of the results. Fourth, the participants were allowed to choose the intervention regime they preferred, which probably reduced the drop-out rate. Drop-out during the study was comparable to that reported in other similar studies and it was factored into the study design.

In light of the aspects discussed earlier, we may conclude that the results of our study are generalizable to the older

home-dwelling population in other parts of Finland and in other similar cultures. The design and implementation of the study could also be applied in other older population. However, the effect of social intervention of the present kind on loneliness and depressive mood among older populations requires further research.

Conclusion

In sum, the effects of the social intervention of choice were moderate and did not expedite the process of overcoming depressive mood or loneliness. These phenomena were somewhat alleviated, but these improvements occurred independently of the intervention. Notwithstanding, our secondary analysis suggests that some positive changes occurred in perceived social integration as a direct consequence of the intervention, and the improvement was parallel in each of the three intervention regime. Loneliness, melancholy, and the dimensions of perceived togetherness are intertwined, and thus more research is needed to achieve deeper understanding of the links between these psychosocial phenomena.

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